Motor Age®

Advancing the Automotive Service Professional Since 1899

June 2015

Talk Shop Anytime

AUTOPRO WORKSHOP

Vol. 134, No. 6

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MORE THAN 2,000 TRAINED AT AUTOMECHANIKA CHICAGO

SHOP OWNERS, TECHNICIANS GAIN KNOWLEDGE AT LARGEST US TRAINING EVENT

TRENDING

MASTER THE COMPUTER IN YOUR BAY

Take advantage of the benefits technology can provide

TECHNOLOGY

FINDING THE LITTLE ONES

Tips on finding that evaporative emissions' very small leak source

OPERATIONS

SELLING DIAGNOSTIC TIME

Diagnostic services offer value and work as a profit center

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ENHANCING THE DIAGNOSTIC CHECKLIST

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June 2015 Vol.134, No. 6

Motor Age

24950 Country Club Blvd., Suite 200,
North Olmsted, OH 44070
Fax: (440) 891-2675
www.motorage.com

Talk shop anytime

AUTOPRO WORKSHOP

EDITORIAL STAFF

Group Content Director
Michael Willins
mwillins@advanstar.com
(440) 891-2604

Content Channel Director
Krista McNamara
kmcnamara@advanstar.com
(440) 891-2746

Technical Editor & Director of Training
Pete Meier ASE
pmeier@advanstar.com

Art Director
Steph Bentz

Senior Designer
Stalin Annadurai

Contributing Editors
Vanessa Attwell
Brian Canning
Mark DeKoster
Chris Frederick
Bill Haas
Dave Hobbs
Tim Janello
John D. Kelly
Dave Macholz
Richard McCuistian
Mike Miller
Albin Moore
Mark Quarto
G. Jerry Truglia

Editorial Director, ASE Study Guides
James Hwang
jhwang@advanstar.com
(714) 513-8473

SUBSCRIPTION CHANGES/ CUSTOMER SERVICE
(888) 527-7008
(218) 740-6395

BUSINESS STAFF

Vice President/General Manager
Jim Savas

Group Publisher
Terri McMenamin
tmcmenamin@advanstar.com
(610) 397-1667

Business Manager
Nancy Grammatico

Administrative Coordinator
Adriana Silva

Sr. Production Manager
Karen Lenzen
(218) 740-6371

Circulation Director
Kristina Bildeaux

Circulation Manager
Tracy White
(218) 740-6540

Marketing Director
Boris Chernin
bchernin@advanstar.com
(310) 857-7632

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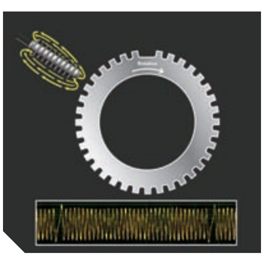

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SALES STAFF

Midwest & Western States
Michael Parra, Regional Sales Manager
Tel: (704) 919-1931
mparra@advanstar.com

Illinois, Eastern & Southern States
Paul A. Ropski, Regional Sales Manager
Tel: (312) 566-9885
Fax: (312) 566-9884
propski@advanstar.com

Ohio, Michigan & California
Lisa Mend, Regional Sales Manager
Tel: (773) 866-1514
Fax: (773) 866-1314
lmend@advanstar.com

Inside Sales/Classified Sales/ Recruitment
Keith Havemann, Sales Representative
Tel: (310) 857-7634
Fax: (310) 943-1465
khavemann@advanstar.com

List Rental Sales
Tamara Phillips
tphillips@advanstar.com
(440) 891-2773

Permissions/International Licensing
Maureen Cannon
(440) 891-2742

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»» MOTORAGE.COM/EVAPTIPS

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EVENT WRAP UP

Automechanika Chicago trains more than 2,000 shop owners, technicians

CHICAGO – Automechanika Chicago opened its doors April 24-26, bringing to fruition a goal the event's parent company, Messe Frankfurt has been working toward for nearly 18 years: to bring the Automechanika brand to the United States.

The largest trade show dedicated to the automotive aftermarket industry and high-end technical training garnered a successful turnout with a diverse group of exhibiting companies and nearly 6,000 attendees. More than 450 exhibitors from 23 countries showcased the newest tools, equipment and products for the automotive aftermarket industry. The event was also declared as the biggest platform for industry training, hosting more than 100 seminars and workshops with more than 2,000 shop owners and technicians attending the seminars.

"Our passion for the industry and the opportunity to bring the aftermarket manufacturers and suppliers together with the shop owners and technicians has fulfilled a drream," said Dennis Smith, president of Messe Frankfurt North America. "We appreciate the support of the industry in making this a reality and we look forward to an even more successful event in 2017."

[Automechanika Chicago] CONTINUES / PAGE 7

Photos: Krista McNamara

BREAKING NEWS

TRAINING

MASTER THE COMPUTER IN YOUR BAY

You know that computers are important. You know they're here to stay. And while you can master some fairly technical tools in the bay, that computer still can trip you up.

Enter Scott Brown, president of the International Automotive Technicians Network (iATN), who at Automechanika Chicago gave technicians, owners and other shop employees some computer knowhow in his presentation, "Leveraging Your PC for the Automotive Service Professional."

"This class is designed to share some of the challenges I've seen

[Computers] CONTINUES / PAGE 7

Discussion is ongoing in MotorAge.com forums

[Computers]
CONTINUED. FROM PAGE 6

many technicians in the field presented with in regards to PC usage. Computers are now an integral part of our daily routines," said Brown, who shared tips to make life in the shop easier.

Attendees, all of whom were encouraged to bring a laptop or tablet to the class, learned tips and tricks from Brown through data points and examples he pulled live from iATN.

> **"Many technicians have been using computers for years but fail to take full advantage of some of the other benefits they provide."**
> – Scott Brown

"Many technicians have been using computers for years but many fail to take full advantage of some of the other benefits they provide in regards to their profession," Brown explained. In the seminar, he shared a multitude of tips one can use immediately to further their profession.

And that's true, as the attendees left the class with an understanding of how to take and markup screenshots (and why this is important), as well as setting up and optimizing their Internet browsers for efficiency. They also learned more about researching issues on iATN and new integration features with Direct-Hit.

SIMPLIFY MISFIRE TROUBLESHOOTING

Tracking down the cause of a completely dead engine cylinder is relatively easy: either the ignition has failed, the cylinder is not getting the fuel it needs or there is a mechanical failure preventing the cylinder from compressing the air/fuel charge.

Tracking down the cause of an intermittent misfire, or one that results in only a partial power loss, can be more of a challenge – a challenge attendees of Scott Shotton's Automechanika Chicago class "Misfire – Efficient and Effective Diagnosis" would soon be prepared to meet.

Shotton has a lot of experience as both an instructor and as a drivability technician. He has more than 20 years of technical experience in automotive repair shops and currently teaches automotive technology at Kishwaukee College. He also is one of four trainers administering training for the Illinois EPA's emissions testing program. As owner of The Driveability Guys, Shotton also performs mobile diagnostics and reprogramming for local repair shops.

He brings this real world experience of helping shops to his classroom. His class incorporates not only theory but practical case study examples that show attendees how to put that theory to use on real problem cars.

"This is how I use these techniques," Shotton told his class, "and you should be able to use them tomorrow."

Each case study presented was used to illustrate a specific point or technique. Shotton encouraged participants to analyze the data presented to help them master the skills and techniques he was teaching.

"Techs attending my class should immediately be able to streamline their misfire diagnostic procedures and increase their diagnostic accuracy with the techniques I cover," Shotton shared after his class. "Both will only contribute to their productivity and their bottom line."

[Automechanika Chicago]
CONTINUED. FROM PAGE 6

Messe Frankfurt, producer of Automechanika, the leading international brand in the automotive trade and aftermarket arena, and UBM Advanstar, one of the largest trade show organizers in the U.S. and publisher of *Motor Age*, *ABRN* and *Aftermarket Business World*, joined forces to launch Automechanika Chicago. The show was the 14th Automechanika event around the globe, and the first-ever in the United States. The next show is scheduled for spring 2017.

"As a global brand, we are happy to introduce Automechanika to the United States. We found the right focus for the show and partnered with the right organization to bring a unique platform that includes high level training to shop owners and technicians," said Michael Johannes, vice president of Automechanika.

The trade show was focused on three main areas: innovation, education and inspiration. In addition to new products and advanced technologies presented, show floor demonstrations and training seminars allowed shop owners and technicians to meet suppliers and vendors from around the world and to learn about the latest trends.

WHAT TO KNOW ABOUT REFRIGERANT

New refrigerants are being used in current production line cars. R1234yf is the current replacement in use overseas to meet the European Union's ban on R134a, and it also is being used in domestic vehicles in the U.S. to earn CAFE credits in an attempt to soften the impact the new fuel economy requirements are having on OEMs. Additionally, the EPA announced its intent to phase down use of R134a in new model cars and has approved additional refrigerants for use in mobile A/C systems.

Why are we dropping R134a? What does this really mean for the shop owner and independent technician? What impact will it have on the industry?

Automechanika Chicago attendees were able to get answers to these questions and a whole lot more from experts in the area of mobile air conditioning and the new refrigerants. Peter Coll, vice president and managing director of Neutronics Refrigerant analysis, and his co-presenter, Mary Koban, Opteon®YF Global Technical Lead representative, addressed these issues and helped attendees prepare for the future of mobile air conditioning service and repair.

In addition to the qualifications their jobs bring, one should also note that both are members of the SAE Interior Climate Control Service committee, with Coll acting as vice-chair. The two were and are actively involved in the global process of incorporating replacements for existing gasses. They know first-hand the challenges that were presented, as well as those that still face us as an industry.

ASE GUIDES

QUESTION OF THE MONTH

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A. LDP
B. VSV
C. CCV
D. VODEndFragment

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FROM THE BLOG SPHERE

Automechanika Chicago event rocked!

Vendor shares their experience at inaugural training event

BY **GARY HIXSON** | WRITER

In late April, I had the unique opportunity to attend the Automechanika Chicago show. I was there as an exhibitor for Mitchell 1 in a booth that we shared with Snap-on Diagnostics and Snap-on Equipment.

When you hear the name Automechanika, you probably think immediately about the G-I-A-N-T and traditional all-automotive trade show held every two years in Europe — Frankfurt, Germany to be exact. Automechanika Chicago is actually the 14th installment into the Automechanika worldwide event lineup and marked the first time Automechanika has come to the U.S. There are plans to continue the event on an every-other-year schedule.

Automechanika is geared to automotive repair shop owners and technicians to give them an opportunity to network, attend industry training, and view the latest products from hundreds of exhibitors.

My participation in the event included staffing the booth to greet our guests, answer questions, offer tips for using Mitchell 1 products, and to show off our latest product features like 1Search, SureTrack Real Fixes

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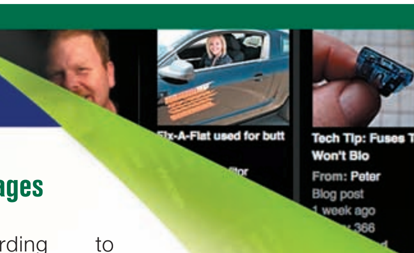

BEST OF THE BLOGS are articles written by bloggers on Motor Age's community pages

Brian Albright

Mishandling phone calls costs dealer service departments

Dealership service departments that let overflow or after hours phone calls slide into a voicemail black hole may be missing out on significant revenue and losing potential new customers. Research from DMEautomotive published in January indicates that dealerships are missing out on calls from customers who represent nearly one-third of their total service dollars.

The study of 8,537 overflow and after-hours service calls at 172 dealerships identified nearly 70 percent of those callers as "swing loyalists." These customers represent 31 percent of all dealership service dollars and have a high propensity to become loyal customers. The data also showed that one fifth of those potentially missed calls were from dealership "loyalists" who represent 59 percent of dealership service dollars.

"The message of this data could not be clearer: dealers must have effective programs and processes for handling after hours and overflow calls or risk losing a large chunk of service revenue and critically valuable loyal customers," says JoAnn Bedenbaugh, vice president and general manager of DMEautomotive's Customer Interaction Center. "With the explosion of smartphone usage, the phone call has once again become an essential source of leads and communication with customers. In fact, phone leads are growing at a greater pace than Internet leads – and, as our data shows, represent some of a dealership's highest value service opportunities. Unfortunately, those are the calls most likely to be missed."

According to Mike Martinez, chief marketing officer at DMEautomotive, after-hours calls usually go unanswered, which drives those customers to seek out service at other locations. "The go someplace else," Martinez says. "The dealers are missing out on an opportunity to service a customer that is halfway in the can, but also halfway out of the can."

When customers call after hours, they typically either get a generic message indicating the dealership is closed, or they go into a general voicemail system. In most cases, they never get a response if they leave a message. Overflow calls occur during business hours, but those calls also wind up in voicemail. Continue reading at Motorage.com/Mishandling.

(real-world information), and ProView. Thank you to all of our customers and attendees who stopped by.

I also had the opportunity to present a product demonstration on the show floor's Repair Stage to show how ProDemand can help you keep pace with technology innovations in "6 ways to save time on repairs."

It was truly a great experience to be part of this event. Continue reading at Motorage.com/Rocked MA

MotorAge TOP VIDEOS

MOST WATCHED VIDEO

Use technology to boost efficiency in your shop

MotorAge.com/technologyshop

Chubby's Tip of the Week
Chris "Chubby" Frederick, CEO of Automotive Training Institute, talks with Motor Age about why service repair average repair orders can decrease.
Motorage.com/Decrease

Gaining customer loyalty
In pursuit of state-of-the-art methods to enhance customer loyalty, Motor age talks to Steven Stein, a 10-year automotive aftermarket veteran who is the eServices Solutions Manager for MOTOSHOP Technology Tools, a program that offers repair shops an array of online management solutions.
Motorage.com/Gaining

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Noteworthy

comments from *MotorAge*'s online communities

The best of what you're saying in the Motor Age Magazine group on LinkedIn

Nancy Patton Bishop wrote:
In his recent *Motor Age* article "Young technicians are an endangered species," Brian Canning talks about how fewer and fewer young people are choosing automotive repair as a future career. According to the Manpower group, the auto repair technician is one of the hardest positions to fill. What's been your experience in your shop? Are you experiencing a shortage of younger technicians? And if so, why do you think that is?

John Oliver, Automotive Equipment Technician, Verizon:
Here's my take on it: The younger generation has a sense of entitlement in regards to pay. A job that you supply your own tools is an especially big issue when you first start. Certain pay plans, namely flat rate, need to go away. The hourly plans need some incentives. I've been in this field my whole life. I do not make recommendations to anybody to come into this field. Low pay for years to make a livable career!

Dan Warning, Associate Professor, Joliet Junior College:
There really isn't a "shortage of young technicians," there is a shortage of qualified young technicians. Any fool can buy a few tools and call themselves a "technician" and work for someone willing to give them a try or, worse yet, go into business for themselves in the garage behind their house. We have a 2-year program where we give the students a foundation of basic skills to make a successful entry into the automotive service sector in a technical sense.

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Alternate revenue streams that go beyond automotive work
Any vehicle that can be repaired and sold for market value can be an additional source of income. *ABRN.com/Alternate*

BASF names distributor of year
BASF's automotive refinish business recently awarded Colortone Automotive Paints its 2014 ColorSource Distributor of the Year Award.
ABRN.com/Colortone

Five easy steps to help improve paint and materials margins
There are several steps that collision shop owners and their paint departments can utilizethat are almost guaranteed to quickly improve profits. *ABRN.com/Fivesteps*

AFTERMARKETBUSINESS.COM

Uni-Select acquires distributors
Uni-Select Inc. announced that its FinishMaster subsidiary acquired the assets of two aftermarket distributors.
AftermarketBusiness.com/Finnish

Five Idaho students receive Albano Scholarships
Five students from Idaho planning careers in automotive or heavy-duty aftermarket industry received scholarships through the Global Automotive Aftermarket.
AftermarketBusiness.com/Five

Autozone edges Advance Auto Parts as largest aftermarket retailer
When all North American company-owned stores are counted, AutoZone is comes out on top. *AftermarketBusiness.com/Edges*

2015 INDUSTRY EVENTS

June 13-14
Schaeffler REPXPERT Live Training, Torrance, Calif.

July 21-25
NACE|CARS 2015, Detroit, Mich.

November 2-5
AAPEX 2015, Las Vegas, Nev.

November 3-6
SEMA 2015, Las Vegas, Nev.

November 4
NASTF General Meeting, Las Vegas, Nev.

OPERATIONS
TAKE CONTROL OF YOUR BUSINESS

IN THIS SECTION

read it on MotorAge.com

AMI TO AWARD SCHOLARSHIPS
Awarded to those who strive to be or are currently in a management role.
/amiaward

TECHNOLOGY FORUM RETURNS
NACE|CARS will again host the Technology & Telematics Forum.
/carsforum

TOP SHOPS CONTEST
The 2015 Motor Age Top Shops Contest is now open!
/2015topshops

MANAGEMENT

SELLING DIAGNOSTIC TIME

UNDERSTAND THE GREAT VALUE OF DIAGNOSTIC SERVICES AND ITS POTENTIAL AS A PROFIT CENTER

BY **BRIAN CANNING** | CONTRIBUTING EDITOR

ONE OF the most misused members of the technician team in many shops is the diagnostic technician. I am talking about the highly skilled, highly experienced guy or gal who is, or should be, our diagnostic technician because of his or her sheer knowledge, broad experience and strong diagnostic ability. This individual is worth their weight in gold, though far too often we sell their services very similar to the way we sell and advertise a $15 oil change. Diagnostics in today's environment are tough; require a very special skill set and temperament, but far too often, we discount or give these services away, missing huge opportunities for sales, profits and believe it or not, customer good will.

The selling of diagnostic time is one of the most misapplied, mismanaged activities out there. By description, diagnostics are undefined and open ended, and therefore need to be managed very carefully, assuring they are thorough and complete for the customer's sake, well managed for our technician's sake and profitable for the sake of our shop. Most of us shudder at the prospect of a tough diagnostic job because, by its very nature, the outcome is unclear. Rather than doubling the pain by making the undertaking unprofitable, we need to strive to make it an important and profitable part of our business. A great first step in this is to stop giving it away!

A great second step would be to stop doing free estimates on work that has the potential to involve diagnostics. Giving a free estimate on a brake

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squeak or tire vibration is one thing, but doing so on diagnostic work is asking for trouble. You cannot always know what repairs will involve diagnostics, but being alert to the possibility is very important. As soon as we know, our customer needs to know.

When we give diagnostic time away, or sell it cheaply, we are saying to the customer that the most difficult, demanding and intense service we provide has little or no value. On top of that, we are taking a service that is, in most cases, performed by our most knowledgeable, experienced and highest paid technician and turning it into a money loser. Competence and technical ability are of a far greater value than that $15 oil change, and our customers know and appreciate this, even if we don't.

Rather than apologizing for diagnostics, I am going to suggest we start bragging about it. Rather than discounting it, I am going to suggest we institute an elevated diagnostic rate that is at least 25 percent higher than our floor rate. Rather than tiptoeing around it and selling a single hour, I am going to tell you to have a consult with any diagnostic customers. Let them know that major surgery may be required; we won't know what it is or what it will cost until we get in there. We have our best technician on it; and we will let them know what we find. Most customers will appreciate this approach — a few will not.

If we cannot do diagnostics profitably, we should not do them at all. The bottom line is that the very second we start talking about diagnostics, we are talking about something out of the ordinary. Our customers know this and though they are worried because we are asking for their permission to dive in on something that may or may not be expensive, they need their car, they understand the urgency and we are (or should be) the expert.

Many of us agonize over setting our hourly labor rates. Through our inefficiency and our tendency to discount and write poor or incomplete estimates, we often make this exercise meaningless as our effective labor rate declines and labor profits fall below where they should be. This is particularly true if we are offering free estimates on diagnostic work, and is amplified if we are discounting the labor we would charge on these complex services. If we pay our diagnostic tech for two hours and charge our customer for one hour, our effective labor rate is about half of what it should be. Our ability to maintain an effective labor rate at or very near our actual hourly rate will go a long way toward ensuring the profitability of our diagnostic services and our labor operation as a whole.

Effective labor rate has nothing to do with tech productivity; more correctly, it is a way of measuring how well we convert the labor hours we are selling into actual labor sales dollars. If we have a diagnostic labor rate of $125 and we sell two hours of diagnostic labor, we should generate $250 in diagnostic labor sales. Effective labor rate is entirely a measurement of our ability to protect the integrity of that hourly rate.

In the example below, we compare two transactions that include two hours of diagnostic time; the first using the existing floor rate of $100 per hour with a 25 percent discount for the customer; the second using the elevated diagnostic rate of $125 per hour with no discount. We are paying the technician $30 per flat rate hour.

Using our floor rate of $100 and giving our customer a 25 percent discount, our gross profit percentage on those two hours of diagnostic labor is 60 percent, and our gross profit ($) is $90. Our effective labor rate is only $75. With the elevated diagnostic rate we described above and our being disciplined enough not to discount our diagnostic labor cost to the customer, our gross profit percentage is 76 percent, our gross profit is $190 and our effective labor rate is $125. Quite a big difference, wouldn't you say? Diagnostics are tough enough, but if we are discounting that diagnostic labor and driving down our profits and effective labor rate, they might not be worth doing at all.

In putting together a diagnostic rate, we strive to have a number that is competitive in our market area but more importantly, at a level that will support the compensation plan we have in place and produce reasonable profits for the diagnostic work we are doing. If we are consistently missing this mark, we are consistently missing out on sales and profit dollars that allow us to prosper and grow. This tends to be doubly true for diagnostic time.

The solution will likely require adjustments at both ends — an hour labor paid to the tech for an hour labor charged to the customer. My strong recommendation would be to review what goes into each of these diagnostic services and adjust them so that we can be competitive (not the cheapest and not the most expensive in our market area) and profitable! Effective labor rate is critically important in assuring that our labor operation is yielding the sales and profits we had anticipated in setting that hourly rate. The viability of our business demands that we are paid adequately for the labor hours we are selling, and that we are getting an appropriate return. That hour of diagnostic time sold needs to pay an hour and match the hour we are paying our technician.

A great diagnostic technician is a huge asset to our business. He or she is a very different beast than that motivated (or unmotivated) B tech, with a different approach and a very different perspective. Make them a valued member of our team. Pay them for excellence. Market them and market their services, but be profitable in that effort.

Everybody changes oil and does brakes. Only a few among us can perform open-heart surgery (diagnostics), and I promise you, it isn't cheap. Rather than being a money-losing afterthought, diagnostics needs to be central to our marketing and broad strategic plan.

Price is what we pay, value is what we get. Diagnostics and a great diagnostic tech can bring great value to our operation, but only if we are charging adequately for this critical and valuable service.

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

A MOTIVATION BULLSEYE

FIND WHAT DRIVES YOUR EMPLOYEES TO PRODUCE

BY **CHRIS "CHUBBY" FREDERICK** | CONTRIBUTOR

IT IS getting harder to find good people. So if you have employees who are not producing the way you want, you need to determine why. I was listening to Steve Privette, an ATI coach, explain how he helps shop owners with different motivational challenges.

Steve explained that typically there are three causes: they lack the ability, lack the training or lack the motivation. Let's talk about lack of motivation. It's a big problem. When we do find good people, some lack motivation and drive. That service writer may have great customer service skills, nice phone skills and good administration skills. That tech may fix it right the first time, be willing to help other techs and have a good attitude. The problem is that skills alone are not enough.

Many times these people are primarily punching the clock, doing their job, surviving the day and going home — with no real motivation or drive to improve their quality of life. They are living day to day and appear comfortable doing just enough to get by. You are likely visualizing one or more of your employees right now, aren't you?

As an owner, you need to find your employee's motivation and utilize that knowledge to get them to produce more. First things first, what can you do to help find what motivates them? Start by having each of your employees create their own goal poster. The goals should be based on personal and professional achievements. They should be short- and long-term based, covering things to accomplish in the next 12 months and longer. These goal posters will help to give you the information you need to find their motivations. Also, have directed conversations with them and get to know their personal situation (home, spouse, kids, hobbies, etc.).

People are motivated by many different things. Often, they fall into one of these four categories: money; time; material items; or family.

Second, now you have to find out which category (or categories) each of your employees falls under. An employee may be motivated or driven by more than one or even all four categories. You need to have those one-on-ones with them to find out what's important to them.

I am going to give you successful examples from each category that helped me and a few of my shop owners find and use an employee's motivation to get them to produce more.

Money

This is the easy one, and we have done countless motivational pay plans for clients. Many employees are motivated by money, which is great. We need to make sure their pay plan is set up to allow them to have control over their income by production. You expect your employees to produce, and every employee should be — in one form or another — paid depending on their production. And I know this is more difficult in some states than others. How many of you have employees being paid hourly or salary only? Many of you are already aware and may be using the flat-rate system for techs and salary/commission system for writers and managers. Then there are weekly or monthly bonuses in addition that you can create to motivate.

If you believe your employee is motivated by money and they are on a similar plan as above yet still not producing, then they are either too comfortable financially or are really not motivated by money, but by something else.

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"WHAT IS THE BIGGEST MOTIVATOR YOU SEE THESE DAYS IN TECHNICIANS AND SERVICE WRITERS? IT DEPENDS ON THEIR AGE; HOWEVER, MOST ARE MOTIVATED MORE BY FREE TIME THAN MONEY!"

CHRIS "CHUBBY" FREDERICK [ATI CEO]

Time

Not everyone is money motivated. For many, their time is more valuable to them than the money.

The last shop I ran before coming to ATI was a Monday to Friday dealership. I had a tech there who was solid all around. Fixed it right the first time, could beat flat rate (which, by the way, was how he was paid) on most jobs, had a good attitude and was always on time. Here's the problem: he worked 40 hours per week, but rarely produced even 30 billable hours. He worked at a rather slow pace. I sat him down one day and told him, "I need you to produce more hours. Plus, you would make more money!" He replied that he did not care about making more money and he would prefer to work at his stress-free pace. You see, his wife was the breadwinner in his household, so he was not motivated by money. I needed to find a way to get him to produce more for me. I asked him "What is important to you?" He answered, "My free time!"

I found his motivation. So keeping in mind this was a Monday to Friday shop, I said to him, "Give me 40 billable hours by end of day Thursday and you can have Friday off for a three-day weekend."

He did just that and rarely ever worked another Friday again!

I was fine with that because I was getting 40 billable hours a week from him in four days, instead of maybe 30 billable hours a week from him in five days. Sure, I had to move the schedule around a bit here and there, and schedule more appointments Monday through Thursday, but I got what I needed from him by finding his motivation.

Material items

I have a current client who has a tech who wasn't motivated by money or time. He was a good employee! He wasn't really money motivated because no matter how much he made each week, the money was going to his ex-wife and kids. He had a wage garnishment going on, so he would never reap the benefits of it personally. How many of us have one of these techs?

So I told the owner to find his motivation. It turns out this tech was NASCAR crazy — he loved everything about NASCAR.

So the owner developed monthly billable hour goals he needed to produce. We calculated how much more money reaching those goals would put in the owner's pocket, to make sure we could afford to give the tech the appropriate incentive. We determined two monthly levels of billable hours reached for the tech to hit.

If he hit the lower level, the owner would buy him a NASCAR die-cast scale car of his choice. If he hit the higher level, the owner would buy him NASCAR tickets to the next upcoming race. The tech would have to pay to get himself there, but could afford to do that by billing those extra flat-rate hours. The tech has reached one of those levels many times. Not always, but often.

You can use this format for any material items for any employee who is motivated by this.

The bottom line is we found his motivation and used it to benefit both the owner and the tech.

Family

Another shop owner of mine had a service writer who he really liked, but this service writer wasn't hungry. Customers loved him; he had great phone skills, good organizational skills, was good with the techs and dependable. We even paid him salary plus commission based on weekly gross profit dollars. It just seemed that money wasn't really motivating him to produce more and grow. So you can probably guess what I told the owner to do. "You need to sit down with him and find his motivation. You need to ask him what's important to him."

The owner did so and determined that the most important thing in the world to this service writer was his nine-year-old daughter. He was a single dad, and his world revolved around her — understandably so. He knew that earning more money would allow him to provide more for her, but he wasn't a saver and really wasn't good with his money, like many. How many of you have employees who get paid on Friday and are broke by Monday?

The owner and I decided to open up a savings account in his daughter's name, and every month the service writer hit a monthly gross profit dollar goal, the owner would deposit money into her account. It turned out to be incredible, as this service writer just took off producing, month in and month out. We found his motivation!

Find their motivation and you will find production! If you want to learn how we manage an employee's performance monthly with rewards and recognition, we have an outline we give our clients called Managing Performance with Monthly Goal Setting, and for a limited time you can download it by going to www.ationlinetraining.com/2015-06. MA

CHRIS "CHUBBY" FREDERICK
CONTRIBUTOR

Chris "Chubby" Frederick is the CEO and founder of the Automotive Training Institute. ATI's 108 associates train and coach more than 1,250 shop owners every week across North America to drive profits and dreams home to their families. Our associates love helping shop owners who are having 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 ATI Coach Brian Hunnicut.

E-mail Chubby at cfrederick@autotraining.net

DON'T BURY YOUR HEAD IN THE SAND

IT IS TIME TO REFOCUS, STOP DWELLING ON THE PAST AND BE THE BEST YOU CAN BE

BY **BOB GREENWOOD** | CONTRIBUTING EDITOR

IN THE last 6 months, has there been a time when you just wanted to give up? Every business person can relate to that question, and let's be honest, every business person has experienced partial burnout because of being under staffed, which creates a self-overworked syndrome.

So let's stop feeling sorry for ourselves and understand what has taken place.

There is so much change and discipline required to be in business today. And often the longer you have been in business the easier it is to say, "The heck with it," and plan to give up. These shop owners and managers may end up putting their head in the sand.

If you give up trying to be the best version of yourself, your actions will haunt you. Tremendous regret will stay with you for the rest of your life, and you may end up saying, "If I only stuck with it and got things done…"

Many business people enter a stage called Business Normalcy Bias. When you are in a state of Business Normalcy Bias it means you are overwhelmed with all the change that is required and simply believe these changes can't happen. So you say, "Why should I keep trying?" Let's look at the formal definition of normalcy bias and bring it into context for the shop owner who is going through this.

Wikipedia explains the normalcy bias as "a mental state people enter when facing a disaster. It causes people to underestimate both the possibility of a disaster occurring and its possible effects. This often results in situations where people fail to adequately prepare for a disaster.

The assumption that is made in the case of the normalcy bias is that since a disaster never has occurred, then it never will occur. It also results in the inability of people to cope with a disaster once it occurs. People with a normalcy bias have difficulties reacting to something they have not experienced before. People also tend to interpret warnings in the most optimistic way possible, seizing on any ambiguities to infer a less serious situation.

The normalcy bias may be caused in part by the way the brain process-

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es new data. Research suggests that even when the brain is calm, it takes 8–10 seconds to process new information. Stress slows the process, and when the brain cannot find an acceptable response to a situation, it fixates on a single solution that may or may not be correct.

The normalcy bias also causes people to drastically underestimate the effects of the disaster. Therefore, they think that everything will be all right, while information from the radio, television or neighbors gives them reason to believe there is a risk. This creates a cognitive dissonance that they then must work to eliminate. Some manage to eliminate it by refusing to believe new warnings coming in and refusing to evacuate (maintaining the normalcy bias), while others eliminate the dissonance by escaping the danger.

The shop owner who is in a state of business normalcy bias has been overworked because he or she is not properly staffed and under the assumption that they are saving money. They may have failed to delegate duties to current staff because they believe only they can do it right. They may have been doing everything themselves and basically running around like a chicken with its head cut off, so they don't believe they have the time to make the change required to be the best they can be.

They fall into the state of mind that what they have right now will do just fine, and they believe all the changes required or recommended from the people around them simply aren't required in their particular case.

Think about that for a few minutes.

Our industry is in constant change and shop management must learn to adapt, or they will die. Change is NOT an option — it is vital for survival. Slow down and don't get caught in the mental state of not wanting to work at being the best you can be. Start creating a positive frame of mind by following this exercise: Think of two positive accomplishments or experiences you had today and have your staff talk about two positive things that they experienced or achieved today. Do this each and every day at a 10-minute morning meeting and bring the best out of each day. When you experience a positive atmosphere, you will be in a strong position to carry on with your journey of becoming an outstanding entrepreneur. So many people see the enormous talent in you. Why can't you? Fix that! MA

BOB GREENWOOD
CONTRIBUTOR

Bob Greenwood, AAM, is president and CEO of Automotive Aftermarket E-Learning Centre Ltd. (AAEC), a company focused on providing business management resources and development for the independent sector of the automotive aftermarket industry utilizing the Internet environment. Bob has more than 36 years of business management experience within the independent aftermarket industry, consulting independent retail shops on all facets of their business operations. Bob is one of 150 worldwide AMI approved instructors.

E-mail Bob at greenwood@aaec.ca

CUSTOMER SERVICE IN THE SOCIAL ERA

FIVE KEYS TO MASTERING YOUR ONLINE REPUTATION

BY **MICHELLE BIZON** | CONTRIBUTING EDITOR

WITH today's digital reliance stronger than ever, it's impossible to ignore how your online reputation plays a role in the public perception of your auto shop. Consumers are putting more and more trust in online reviews — almost equaling the weight they give personal recommendations from friends and family, according to a 2013 BrightLocal Consumer Review Survey.

While online reputation management remains a thorn in the side of many shop owners, adopting a head-in-the-sand attitude to customer reviews will hurt your bottom line in the end. Can you afford to ignore it? Most likely, the answer is no. Luckily, shop owners can take matters into their own hands and positively influence how they're perceived online.

Take responsibility

It's essential to have profiles on each of the foremost social networks and review sites. Claim your shop's listings on major review sites like Yelp and Google Plus and remain active on content sites like Facebook and Twitter. Just "having the lights on" isn't enough. Establish your presence now, lest you be forced to learn the ins and outs of a network should crisis strike.

More importantly, creating profiles allows you to tweak your notification settings, allowing you to choose to be alerted about customer activity involving your business listing or page. Doing so gives you the opportunity to respond in a timely manner.

There are thousands of social networks and review sites out there — not to mention millions of blogs — so, obviously, you'll need to prioritize your time and resources. If a particular review site doesn't show up until Page 20 of your Google search results, then you shouldn't pull out your hair over it. You can catch many new mentions by setting a Google Alert for your business name and city, and free social listening tools like Topsy can help notify you of the occasional mention coming up from the depths of the Internet.

Respond, publicly and quickly

Remember, how you handle reviews doesn't affect only the reviewer. Potential customers and even current customers are checking out your review sites, even if it's just to look up your hours or phone number.

Your responses should send a clear message: We care about our customers' satisfaction and will go above and beyond to ensure each compliment, question and/or complaint is addressed. We've seen that personal attention do more for a business than posting a sales-y "Our service is the best in the world" message.

If you received a positive review, congratulations! Be sure to express your gratitude to your customer by posting a public response to thank him or her for taking the time to review you. Doing so will strengthen your relationships with these customers and make them more likely to advo-

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cate for you in the future. It can also encourage other happy customers to leave reviews themselves, because they know they'll receive that same treatment.

If you received a negative review, the first thing you should do is take a look into the experience described by the reviewer. Are the comments valid? Which of your staff members interacted with the customers, and what are their takes on the situation?

If your business was in the wrong, apologize and take personal responsibility for resolving the issue. Outline what you're going to do about it — we've seen anything from issuing a genuine apology to immediately dismissing a disrespectful employee. Most customers just want to feel like they're being heard, and they'll appreciate the personal attention.

If the customer was wrong, then you need to outline all of the information you gathered about the situation in a matter-of-fact, respectful manner. Oftentimes, it's a misunderstanding. The customer may be confused about something, and leaving the review was his way of venting. Records are your friend here. Do you have a copy of the invoice? Can you take a look at the security camera in the corner and verify (or debunk) what was described?

I handled a review for a customer once, in which the reviewer accused her auto technician of smoking in her car. The security footage showed it was actually her husband. Now, that's a delicate situation in and of itself, but it really describes how your response as a business owner can affect your reputation — to your benefit or your detriment.

Listen and learn

Positive or negative, reviews from customers can also be a valuable learning tool for you and your team. It's easy to see your shop through rose-colored glasses, especially because it takes up so much of your consciousness on a daily basis. Reviews can provide a new, more objective perspective.

If your customers all rave about your accommodating hours, you'll know this will be an irresistible hook for attracting new customers. You can then play it up in your marketing materials, when, otherwise, you may have focused only on your customer service skills or the certifications of your technicians.

If you start seeing a pattern with the same issue coming up again and again, then you have a business problem — not a review site problem. Your customers will tell you what's important to them, be it a rude receptionist or the vending machine in the waiting area being empty. Learn from their feedback and make the necessary changes in your shop.

Ignore the trolls

There may come a time when, despite your best efforts, you find your customer unwilling to engage with you in a respectful dialogue. It's reasonable — and warranted, even — to feel defensive. You pour your blood, sweat and tears into your shop daily, and someone's attacking it! How dare he?

Now, a pep talk. Your customers aren't stupid. Or crazy. One complaint or a temporary dip in your Yelp rating won't send them running for the hills — unless you give them a reason to do so by dealing with a situation poorly. Users are pretty savvy and want to see the overall picture of your business, so a negative review isn't the end of the world.

And if a customer turns into a troll? Your time would be better spent attracting others who fit your ideal customer profile than trying to win over the rabble-rouser.

Be proactive

Practicing quality customer service online goes beyond just listening to your customers and responding to reviews.

The best way to ensure you're being found is to claim your business listings and make sure all of your information is updated. Check your business name, address, phone number and website, in particular. Also, you'll want to add a brief description of the services you offer — most sites include a bio section — and fill out all fields related to your services completely. If someone is searching for a shop that offers a shuttle service, and you forgot to include that, you're probably not going to show up in their search. Don't forget to add photos with captions that'll help prospective customers see what life is like at your shop either.

To generate more and/or better reviews, first focus on awareness. Many happy customers don't realize you need their help; and, even if they do, they don't know how to help. Train your staff members to ask customers to review you. For example, after turning the keys back over to a customer, your tech could say, "We're always looking for feedback for how we can best serve you. We'd love to hear your thoughts about your experience on Google Plus." Reinforce the message by putting the site(s) of your choice on your receipts, invoices, brochures, flyers and whatever else you hand out to customers. If you have an announcement screen, put it up there, or put a sticker in the window. The same applies online. Link to the sites from your website and cross-promote your review sites on Facebook, Twitter and Google Plus.

We caution you to avoid overwhelming them with information, so ask for just one thing. Don't say, "Please review us on Yelp … and Google Plus … and Cityseach … and … and … and." Focusing on one thing at a time will get you better results.

Final thoughts

As in the "real" world, the best way to manage your online reputation is to provide an excellent experience for your customers. There are no shortcuts, but the more committed you are to quality customer service, the more likely you are to attract customers who will become loyal advocates for your shop for years to come.

MICHELLE BIZON
CONTRIBUTOR

Michelle Bizon is the Social Media Manager at Moving Targets. Her team helps hundreds of businesses engage their community, protect their online reputation and define their competitive advantage. Moving Targets is a print and digital marketing firm with more than 20 years of automotive industry experience. They help businesses build trust through campaigns that seamlessly blend print and digital messaging to reach customers at home, at work and on the go

Contact Michelle at movingtargets.com

SHOP PROFILE

A snapshot of one of the industry's leading shops

RISING SUN MOTORS / COLLEGE PARK, MD

The sun also rises

Shop foresight spurred an early buy-in to import work and a heads up on technology

BY **ROBERT BRAVENDER** | CONTRIBUTING EDITOR

Mike Warshauer. His is a classic story of apprenticeship, advancing to craftsmanship, culminating in ownership. From the 11th grade on he's been involved in automotive repair.

He started off sweeping floors, eventually working his way up the ladder to become the lead tech and shop foreman of Rising Sun Motors in College Park, Md., before finally buying out the business with his wife, Denise.

Foresight has been a feature of Rising Sun Motors since its inception in 1977. "We started primarily on imports," Warshauer recalls, back when virtually no one else worked on Asian cars — hence the name — and this gave them a handy heads-up on technology coming down the pike.

"In '78, Nissan had fuel injection on their 280ZX," he relates. "But when GM started doing the computer controls [in the late 80s], it changed everything for everybody. They were the first to have codes and things of that nature, where you could get scan data, diagnostics — they were way ahead of everybody on that."

Since Rising Sun Motors now covers all makes, there are no questions when it comes to hardware; if it needs to be bought, he'll buy it. "You can't do it without (the right equipment)," Warshauer states. "These cars are designed to be diagnosed in a certain manner, and all of the literature you get is written for you to use that tool. If you don't have it, it's all smoke and mirrors; you can't do it."

Warshauer also reports being an early adherent of seminars. "I'd say since 1980, if a seminar came along, I went to it. I've even gone to the same classes two or three times, but I always pick up something that I miss. I try to get my guys to have that same attitude, because you're not going to wake up one day and know this stuff. You can try and read it out of a book, but I find this difficult unless you have somebody there to ask questions of," he says.

As it turns out, ATI's corporate headquarters are about 15 miles away in Linthicum, Md. "I was at a seminar there a couple weeks ago," Warshauer

RISING SUN MOTORS

Michael and Denise Warshauer
Owners

College Park, Md.
Location

1
Number of locations

38
Years in business

9 / 5
Total number of employees/techs

5,000 square feet
Shop size - main location

9
Number of bays - main location

$1.4 million
Annual gross revenue

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Shop affiliations

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says, "and one of the things they talked about is the first time a person comes in they're a client, the second time they become a customer. I'd like to think that we have lots of customers; we have some who have been coming here for 30 years."

Like many shops, one way Warshauer builds on this customer base is with a reward system. "If they refer someone to us, we will mail them a $50 coupon," he explains. "And every time they come in they can have what we call Rising Sun bucks that are in $20 increments. We actually emboss them with a notary-style stamp so they can't be copied. Depending on how much they spend, they get these discount coupons for their next visit. I've had customers come in and pay $300 to $400 worth with these coupons."

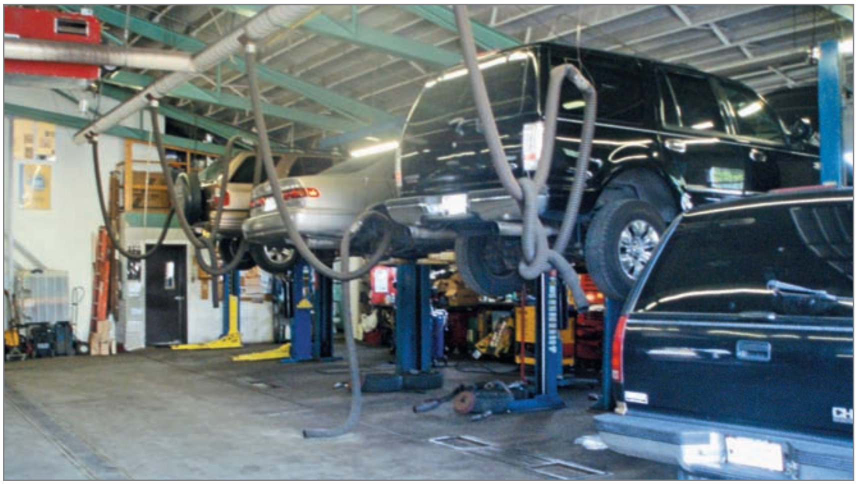
Twice a year the shop does a drawing awarding a total of $325 in free service, divided up into a $150 first place, a $100 second and a $75 third. "We've been doing that forever," Warshauer laughs. "You don't even have to be a customer, you can just do it off of the website; never even come in here and win."

As the name implies, College Park is home to the University of Maryland, as well as a branch of the National Archives. In nearby Greenbelt there's the Goddard Space Flight Center, and a little further still Washington D.C. itself, so a lot of Rising Sun's customers commute. To that end, the shop got a shuttle bus.

"We take a lot of people over to the University or to work," Warshauer relates. "We probably go to Goddard almost every day with at least one person. Then there's the Metro, which goes from the suburbs into D.C., so we'll take people to the (train station) and pick them up at the end of the day. We tell customers to call us at 4 p.m. to let us know if they need the ride, because a lot of times they'll get a ride back with a co-worker. Then we work out the schedules as far as picking them up."

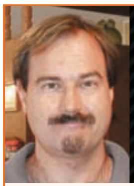
Regarding the virtual highway of the internet, "I believe I embrace it," Warshauer says almost as a question. "I may not embrace it as well as some others, just based on time and ability, but my service manager is much better at it than I am. He stays on top of it, which I believe you need to be very diligent about."

Besides their website, Rising Sun Motors also has a Facebook page and a downloadable mobile phone application, the latter of which can track repairs, post service reminders, and download discount coupons. Warshauer's own approach to customer relations is more direct, one-on-one.



"If there's a problem, all you have to do is come and see me," he says. "I want you to be happy. My standard question is, 'What's it going to take to make you happy?' And we'll work from there."

That's because Warshauer focuses on quality. "You can come up with all kinds of slogans," he affirms, "but if you just do it right, treat people fairly, you don't have to have a catchy phrase. We still have our original 'we are the alternative to the dealer for your import car.' And while you don't necessarily have to be the cheapest guy in town, you just have to be reasonable, affordable. If there are any issues, you have to have an extremely open line of communication with the customer. We treat most of our customers like they're our friends, and a lot of them have actually become one." MA



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

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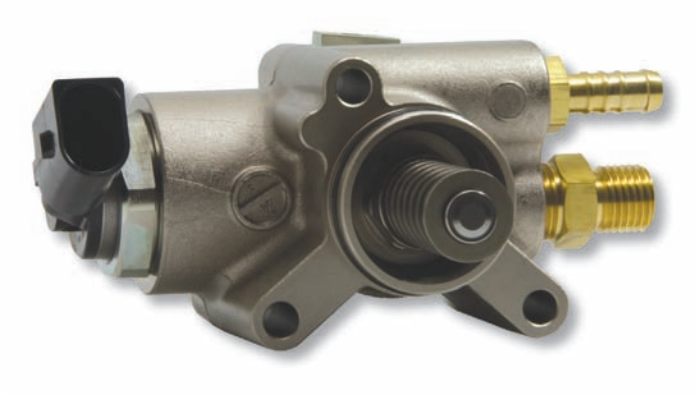

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/u140e

NO LINE RISE
A line pressure gauge reveals no line pressure rise with throttle opening.
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NOT QUITE IDENTICAL
Similar solenoids may be mistaken as identical.
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Enhancing the diagnostic checklist

HAVE A COMPREHENSIVE OVERVIEW TO MOST EFFECTIVELY DETERMINE THE PROBLEM AND WHAT ACTIONS TO TAKE

BY **WAYNE COLONNA** | POWERTRAIN PRO PUBLISHER

THE seminar I had the opportunity to present at Automechanika Chicago this past April was about diagnosing transmission concerns to determine if the cause of a malfunction is related to an engine management problem, an ABS issue or an actual transmission malfunction.

In past seminars and articles I provided in detail a basic diagnostic checklist that was developed from years of diagnosing transmission concerns in shops and on ATSG's technical help line. This list was provided in the introduction part of the seminar handout, which begins with "Information." We look first to see if there are any bulletins or articles already covering the subject. The available diagnostic equipment, as well as the ability to use the equipment, is considered if handling the problem over the phone. Understanding the codes received, checking power and grounds, doing a cursory view of the wiring and connectors while looking for cross-connect possibilities are on this list. Checking into the four main critical PCM/TCM inputs (Engine load, Speed Sensors, Gear Shift Position Switches or Sensor and Temperatures) as well as how the signal is generated and delivered to the controlling computer and computer strategies (ABS, torque reduction, failsafe, sport and economy modes, adaptations, manual tap shift controls, start/stop technology or neutral controls, etc.), transmission misapplication, transmission fluid and aftermarket programming, products and parts round out the list.

Having this comprehensive overview goes a long way in determining which avenue one needs to take based on the problem at hand to get to the cause as quickly as possible. Of course it doesn't completely eliminate every possible headache, but it sure can eliminate

Figure 1

WAYNE COLONNA
is President of the Automatic Transmission Service Group (ATSG) in Cutler Bay, Fla., and a frequent speaker/instructor for transmission training around the globe.

Photos: Wayne Colonna

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many of them. The point is, you need to have a plan and how to implement that plan.

The seminar also provided a specific diagnostic checklist with which to consider when dealing with converter clutch apply issues (**Figure 1**).

Complaint

Before and/or after a rebuild, a shudder or vibration is felt and is perceived as a torque converter clutch apply issue. This shudder could occur during the apply, or sustained through a specific driving condition such as medium throttle cruising. Or, the shudder could present itself on coast down. The converter and related items have been replaced yet the condition remains.

Cause

Many transmissions on the road today utilize some form of a converter clutch slip control strategy, which in time develops problems resulting in shudder complaints. With converter clutch problems, rings, bushings, solenoids, fluids and valve body bore wear being the usual issues causing shudder complaints, other reasons perceived as a converter clutch shudder can be overlooked or not considered at all.

Correction

The following is a list of possible causes to converter clutch concerns, as well as what is not, but is perceived as one. The idea of this list is to provide a wider bandwidth in diagnosing converter clutch issues.

Typical causes of actual converter clutch concerns:

1. The converter itself
2. Moisture/glycol intrusion (**Figures 2 and 3**)
3. Converter clutch related o-rings, sealing rings and bushings
4. Converter clutch related solenoids and valves
5. Incorrect or stretched out converter attaching bolts
6. Adaptations (**Figure 4**)
7. Programming

Typical causes of perceived converter clutch concerns:

1. Active fuel management
2. Motor mount issues
3. Irregular crank shaft signals
4. Air filters, especially oil-soaked filters
5. Mass air flow sensor problems
6. Air intake duct leaks
7. Vacuum leaks
8. Valve timing issues
9. Ignition systems
10. Fuel systems
11. Out of balance drive shaft(s) or tires

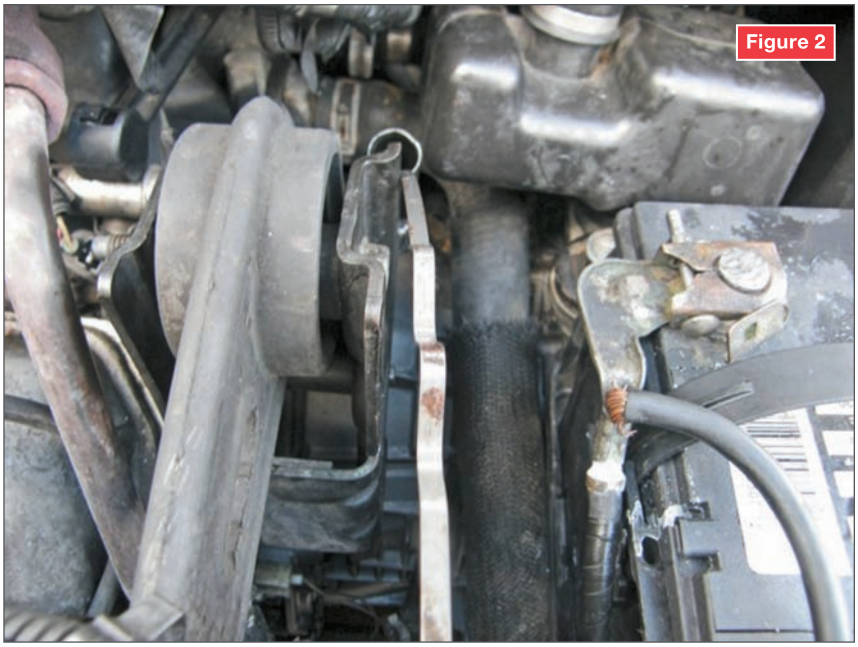
Figure 2


Figure 3

One aspect to transmission problems that not much is written about but was covered in detail in this seminar was about transmission fluid blowing out of the vent and/or fill tube (**Figure 5**). This can be a potential hazard as a fire can develop when extremely hot fluid finds its way to a hot catalytic converter. It was presented as follows.

Complaint

Transmission fluid blowing out of the vent and/or fill tube.

Cause

A clogged or restricted vent will cause fluid to be forced up and out of the fill tube.

For all other venting concerns, there are four basic categories to consider. Depending on the type of transmission having the problem, there are both

common and specific causes within each category. The four basic categories are:

1. Pump Cavitation
2. Transmission overheat
3. Fluid level overfilled
4. Fluid cross leak, splash or spray

Pump captivation

There are two types or causes of cavitation, one being cavitation where the vacuum created in the suction port of the pump causes the air/gas to come out of suspension in the oil, which can be caused by a blocked filter, super cold oil or a restriction in the suction port.

The second type of pump cavitation is caused by an air leak into the suction circuit. The severity of the air being introduced into the system will determine if the fluid will be pushed out of the vent alone, or if it will also be forced out of the fill tube as well. Foaming of the fluid may be observed as well as an erratic pressure gauge.

Examples

Some transmissions could be equipped with either a deep or shallow pan, along with the accompanying deep or shallow filter. If a shallow filter is used when servicing a deep pan configuration, as the fluid moves around when the vehicle is in motion, the pump will suck up air sporadically.

Low fluid level, leak at the join in the two halves of the filter, cracked filters, a compromised filter to case/filter to pump seal, a bad gasket, or a faulty pump will produce the same results.

Both these events will cause cavitation in the pump mesh, which uncorrected will cause damage to the:

- Pump teeth/blades
- Erosion of the pump faces
- Jamming/failure of the pump
- Pressure Regulator Valve instability = valve instability = gearshifts erratic = gasket failure = valve wear = lube failures = seal damage = torque converter drain down and loss of drive, etc.

Transmission overheat

The expansion of overheated fluid can reach levels that will allow it to touch rotating elements inside the transmission. This churns the oil up causing foam, which makes the oil level rise rapidly. The anti-foam agents can not keep up with the foam, the oil continues rising, churning more and suddenly, the oil burps out of the breather.

The greatest heat generator inside the transmission can be attributed to a malfunctioning torque converter. Areas of concern would be a problem with the converter itself, or a torque converter clutch malfunction, or a problem with the hydraulic circuit for the converter. This would include bad bushings, sealing rings, solenoids, related valves in the valve body or pump or both (PR valve, check valves, converter valves, etc.). Some vehicles will prohibit a converter clutch apply if there is a malfunction in the brake system, such as a Toyota Hino using an Allison transmission. Extended driving in high gear with the converter clutch not applied will cause the converter to overheat.

Other possibilities would include warped pump halves or a turned stator support. The cooling system can also be an attributing factor, such as kinked cooling lines, a restricted cooler or heat exchanger, as well as malfunctioning thermal by-pass valves.

Overfilled

An overfilled transmission is typically the first possibility to be considered and resolved. On rare occasions, the wrong length dip stick is being used, which had been inadvertently swapped with a dip stick from another similar vehicle at the time of service. This can occur with fleet accounts doing their own maintenance. On rare occasions, the wrong filler tube had been used or, a damaged one that was incorrectly repaired is the cause. Check for

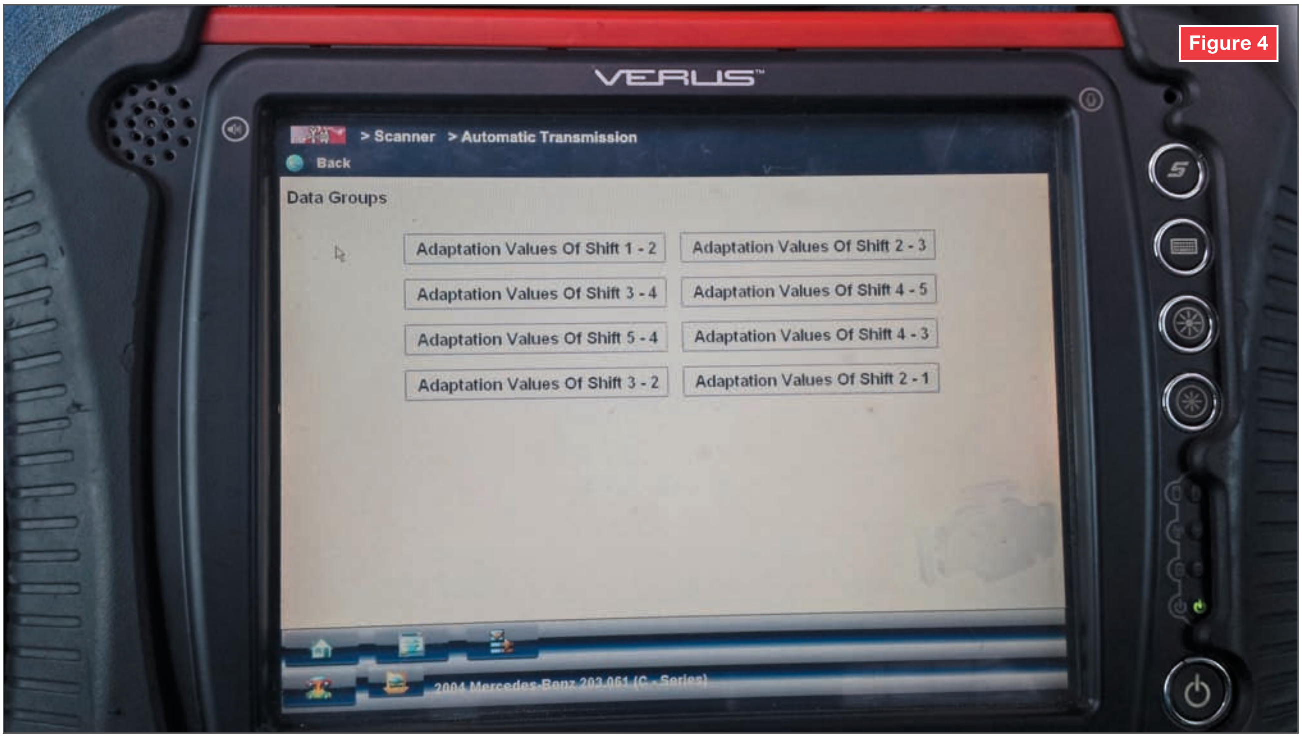

Figure 4

a restricted or clogged vent and repair if necessary and faulty fluid temperature sensor. Check transmissions that are attached to transfer cases or separate sump differentials where seals can leak, allowing for a mixing of fluids.

Fluid cross leak, splash or spray

Fluid cross leak, splash or spray intruding into the vent circuit can be caused by warped pump halves, blown gaskets, or compromised sealing rings. Some undesirable designs will allow fluid splash to enter the vent circuit during sudden stops of the vehicle.

Correction

1. Pump cavitation — Inspect for low fluid level and correct if necessary. If the fluid level is correct, inspect and correct for a defective filter, filter seal or a shallow filter in a deep pan mismatch. Also inspect and correct for a pan that might be pushed up to close to the intake of the filter.

2. Transmission overheat — Begin by inspecting all external possibilities with the cooling system such as kinked cooling lines, defective radiators, restricted coolers, heat exchangers or malfunctioning thermal-bypass valves and correct as necessary.

Once external possibilities have been eliminated, internal components related to the torque converter will need to be inspected. Pressure control and TCC-related solenoids, valves in the valve body and/or pump, pump flatness and stator shaft position and condition, related seals, rings, gaskets and bushings, as well as the torque converter itself. Check for bulletins; sometimes manufacturers have addressed this issue and may have a specific fix. Repair or replace as necessary.

Resolve any brake-related concerns such the ABS or traction control systems.

3. Overfilled — Check for the possibility of the wrong fluid level gauge (dip stick), the wrong fill tube, a tube that was repaired incorrectly or a bent retaining bracket for the tube preventing it from being fully seated. Also check for the possibility of glycol intrusion raising the level, or with 4x4 vehicles that there is not a mixing of fluids due to faulty seals. Repair or replace as necessary. Many transmissions today check fluid levels based on fluid temperatures. If the temperature sensor is skewed and does not produce a fault code, fluid levels will be incorrect. Compare temperatures seen in the scan tool with an inferred laser gun from the pan or return cooling line to determine the accuracy of the sensor. Repair or replace as necessary.

4. Fluid cross leak, splash or spray — If fluid level, pump cavitation and overheat conditions are not a concern and the vent is plumbed directly to the pump, a warped pump may allow fluid intrusion into the vent circuit. If the vent is plumbed into the case cavity, look for blown gaskets or compromised sealing rings that could spray fluid in the direction of the vent. If it is noticed that fluid comes from the vent only when coming to a rapid stop, fluid splash could be the cause. This may require modifications designed to block the splash from entering the circuit. Check for bulletins; sometimes manufacturers have addressed this issue. Repair or replace as necessary. MA


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UNDERHOOD

OBD SYMPOSIUM PROVIDES INSIGHT

The SAE OBD Symposium Organizing Committee includes (from left to right) Mike Regenfuss, Paul Baltusis, Hal Zatorski, Bernard Challen, John Van Gilder, Jeffrey Potts, Andrew Zettel and Bob Gruszczynski.

ANNUAL EVENT ALLOWS OEMS, MANUFACTURERS AND OTHER INDUSTRY CONSTITUENTS TO SHARE EXPERIENCES, IDEAS FOR THE FUTURE

BY **MICHAEL MILLER** | CONTRIBUTING EDITOR

Much like the automotive industry, emission regulations and On-Board Diagnostic (OBDII) technologies used to monitor and diagnose the components that control them advance at an incredible pace. Sometimes, as technicians, we lose sight of the difficulties and challenges faced by the manufacturers when they design a system. The SAE On-Board Diagnostics Symposium provides technicians with the opportunity to interact with the individuals responsible for making the regulations and the engineers who design the systems with which we interact on a daily basis.

Every September, the symposium attracts engineers and industry professionals to network and exchange their experiences in OBD with the California Air Resources Board (CARB) and other industry experts. In turn, CARB provides updates on regulations and standards responsible for establishing emissions requirements.

Last year's event in Anaheim, Calif., featured three days of technical sessions, networking breaks and luncheons, where attendees discussed topics and asked questions of the symposium organizers and speakers. These included engineers from General Motors, Ford, Chrysler, Toyota, Volkswagen and Cummins. Because of the event's proximity to CARB's headquarters, there were several team members present at the event. Attendees shared experiences and discussed new or impending regulations and standards with the group.

The first SAE OBD Technical Workshop was organized by General Motors in 1991. The event was formed to allow CARB to assess where all the manufacturers were with regard to OBD development. The symposium eventually expanded to include heavy-duty content and rotates among major cities featuring both automotive and heavy-duty industries.

The evolution of OBD

The original OBDI regulations totaled three pages in length. Today's regulations have become much more substantial given the technological advancements and complexities that have occurred. Additions to the regulations and associated standards include oxygen sensor monitoring, diagnostic trouble codes, isolation of fault on inputs, in-use rates, Evaporative Emission Control System (EVAP) leak detection, comprehensive component fault isolation, six-pattern testing, rationality vs. functionality diagnostics, smart devices and more.

In the late 1980s, most industry experts thought the key to emissions control was the O_2 sensor. In fact, it was proposed by the SAE Vehicle E/E System Diagnostics Committee that all wires for the O_2 sensor be extended to the vehicle's diagnostic connector (J1962 Connector). The members from that group actually developed Mode $05-Oxygen Sensor Monitoring so that the same data/test results could be read from a generic scan tool.

The SAE J2012 Diagnostic Trouble Code (DTC) Definitions technical

Photos: Michael Miller

report was written in 1990. It defines the standardized DTCs that the OBDI system is required to report when malfunctions are detected. The original document had a total of 152 DTCs. To put that number in perspective, today we have more than 6,000 DTCs.

In 2003, a CARB regulation implemented isolation of faults on inputs, resulting in the circuit open, circuit shorted, and etc. codes.

In-use rates is a familiar term often used with OBDII development. It came about when CARB determined that some manufacturers designed component self-tests to detect faults when performing the Federal Test Procedure (FTP) drive cycle. Unfortunately, they were unable to detect faults during normal customer driving. As a result, CARB set a regulation in which it specified the enabling criteria for a monitor to run. Another group proposed the in-use rate calculation, which uses software to calculate the parameters and also required the monitor to run at specific times.

EVAP leak detection came about when emissions data research showed that any leak greater than 0.008" was considered uncontrolled. This equated to approximately 20 grams of hydrocarbons or more entering the atmosphere each day from the vehicle. Several methods to detect the small leak (less than 0.020") have been tested such as ultrasonic testing — in which air is injected into the system — HC detectors and smoke. Even today, many experts contend that 0.020" is the smallest size leak that technicians will be able to detect in the field.

Another term that technicians may hear is six-pattern testing. This basically refers to the procedure used to test O_2 sensors, as they can fail in six different ways:

- Symmetric Slow Response Rich
- Symmetric Slow Response Lean
- Asymmetric Slow Response Rich
- Asymmetric Slow Response Lean
- Delayed Response Rich
- Delayed Response Lean

Mode $06 has been standardized with CAN, which includes the tests from Mode $05 and is used primarily by CARB for testing and enforcement. It is used for non-continuous monitors. Mode $07 is used for continuous monitors. Another area mentioned in Mode $06 is the Fast Pass, which means that when the threshold for the test is reached, it stops running. An area of confusion for technicians is when they look at the test results and see that the passing result was very close to the threshold. Many take this to mean that the test was close to failing, which is incorrect; it means that once the minimum value was achieved, the test stopped.

Another area of concern to OBDII designers was Input Comprehensive Component Fault Isolation Requirements. This dealt with the difference between rationality fault codes and circuit faults codes. Previous symposium attendees questioned how much fault isolation is required and also if technicians actually use the added fault detection. The example given was for O_2 sensor DTCs; there are 11 DTCs for the front O2 sensor, of which five are circuit codes. The effectiveness of this method was debated at length.

The OBDII regulations define rationality diagnostics being for input sensors and functionality diagnostics for actuators. Technicians often become frustrated following the diagnostic trouble code chart and cannot come to a conclusive determination of the fault code. However, it has been discovered by industry experts that a no-fault found during diagnostics typically averages an astonishing 80 percent among most manufacturers.

OBD discussions at the annual symposium

At the last SAE OBD Symposium, Mike Regenfuss from CARB gave an informative presentation on the OBDII Program Update. Items of interest included:

1. LEV III thresholds for an emission malfunction
2. Changes required for hybrid vehicles

- Monitoring the hybrid battery, including being able to narrow down the fault. It is still undetermined how precise the fault detection must be (cell, module or pack)
- Monitoring of the hybrid cooling system, such as the inverter and actively controlled outputs that maintain the temperature of the cooling system
- Monitoring the performance of the generator, electric motor and regenerative braking system.
- Misfire Monitor for plug-in hybrids

3. Smart devices

- Micro-controlled input/output devices that do not have enough impact to be considered an emission critical module, but are subject to OBDII regulation when the input or output are an emission monitor, comprehensive component or another device that controls an emission component

4. Non MIL guidelines

- Only available to Comprehensive Components
- Requirement is that the system's use is continued in such a way as to have no increase in emissions and the diagnostic monitoring remains functional
- Default strategy must remain in effect until the monitor passes on a successful drive cycle or the fault is cleared by a scan tool

5. Standardizing Fault Codes

- OBDII currently uses a 2-byte structure for fault codes, but this has a limited number of available combinations
- Due to the advances in pinpointing faults, about half of the available codes have been used up.
- Options to address this are using a 3 or 4-byte fault code structure or even developing a completely new fault code structure

Also discussed were additional Data PIDs to evaluate real-world fuel economy, driving habits and performance of off-cycle technologies (cumulative all electric miles, cumulative fuel consumed, cumulative system active time).

Monitors that are problematic will be reviewed, such as EVAP and PCV, as these will present major challenges for LEV III emission requirements. Purge Under Boost is hard to accurately control, so it may be able to test out. The PCV system monitor tests for breaks in lines, but does not guarantee the effectiveness of the system.

Paul Baltusis from Ford shared his experiences over the last year with CARB. One area where Ford systems had an issue was with Dual Path Purge Monitoring. Basically this means there is one purge line for low-load operation and a second high-pressure line that is used during boost conditions. The problem with the system was that the high-pressure line was not monitored for leaks. Baltusis described how the system was redesigned to comply with CARB's requirement. A similar situation with their PCV system also existed where the section of the PCV line that was under vacuum during normal operation was monitored for leaks; however, the pressure line used during turbocharging was not monitored for leaks, so there was no way for the system to know if the line was broken or not connected, allowing crankcase vapors to escape to the atmosphere.

Bob Gruszczynski from Volkswagen presented on how an ECU is determined to be an OBDII ECU and seven different departments are involved in the process. There are only eight CAN IDs available for a vehicle's network, meaning that the choice of which ECUs are a primary OBDII ECU must be chosen carefully.

OBDII communication encompasses the entire vehicle; it does not pertain to a certain ECU. Something the insurance and telematics groups do not understand is that when they query the vehicle, they get more than one response to the same question. This differs from a generic scan tool, since the scan tool realizes it will get more than one response, but only displays one answer. Generic scan tools only communicate with Primary OBDII ECUs.

Gruszczynski also provided some insight into various possibilities to OBD Architecture, such as Smart Code Clear vs. Functional Code Clears. A benefit of the Smart Code Clear is that it only deletes the data and resets the monitor that had the fault, and also any other monitor that is dependent on the item that had the fault. This way other adaptive values and monitors do not have to be relearned or rerun.

Toyota's Mort Smith presented some of his company's OBDII experiences. The industry currently has Low Emission Vehicle (LEV) II standards, in place since the 2004 model year. Vehicles manufactured from 2015-2025 will be under a new category, LEV III.

Smith also discussed the Air/Fuel Ratio Imbalancing Monitor Requirements, which began incorporation in the 2011 model year. All current model year (2015) vehicles should be compliant with the final cut point thresholds. Also warmup catalysts will need to be able to light off faster, which will require them to be closer to the engine on most vehicles. Because a turbocharged engine has a large heat mass, it will not heat up a catalyst as fast as a naturally aspirated engine. As a result, this requires the catalyst to be moved even closer to the exhaust ports on a turbo vehicle. However, this does create conflict because as the warm-up catalyst is moved closer, increased use of over temperature protection must be used, which is basically enrichment of the fuel mixture. On the downside, this will increase CO emissions. Other ways to cool the catalyst were also discussed, such as liquid exhaust cooling.

Jaguar Land Rover (JLR) has also had its share of experiences with OBDII. Martin Haggett's example was that they have had to adjust the MAF Sensor Rationality Monitor to cover a wide range since it is a comprehensive component monitor. Standard MAF sensors use an additive threshold at lower air flows and a multiplicative threshold at higher speeds.

Unfortunately, when more of the JLR vehicles started using the twin MAF setup, changes needed to be made to fit them into the 2010 vehicles. This resulted in false detection of MAF sensor rationality faults. The airflow difference between the banks varied significantly at times, resulting in codes being set. After some research, JLR engineers determined that the miscalculation was caused by side winds, which had a dramatic effect due to the positioning of the air intakes on the vehicle. The side winds created enough of a pressure difference between the two sides to cause the fault.

SAE recently shared updates on its latest efforts on J1979. The standard outlines the communication requirements between OBDII and test equipment with regard to emissions. Some interesting notes are the time to EVAP Decision PID. This means that if a vehicle is brought in for testing and the OBDII system has completed the complete evaporative system monitor in the last 750 miles and there are no pending or present leak codes, the system is considered to be working correctly. If the monitor has not run in the last 750 miles and there are no pending or present codes, then the manufacturer will have the option to run the test in the lab after meeting the enabling conditions.

Some focus was put on generic OBDII starting to use Unified Diagnostic Services (UDS), which several manufacturers are already using. UDS specifies the data link requirements in vehicles and is covered in ISO 14229. It allows the diagnostics to control the functions of a module. This covers data transmission, communications, input and output controls, in-bay services tests, etc. In

addition, UDS would also support the 3-byte DTCs mentioned earlier.

It is predicted that before 2020, we will run out of DTCs, one of the big issues solved by using UDS. It is independent of protocol.

The SAE J1979, which defines the standards for the diagnostic test modes, was invented in 1988. Many believe it is time to move away from that technology and that enhanced data is needed to correctly diagnose a vehicle and even for system maintenance procedures.

OBDII: The service perspective

Not all presenters at the annual symposium were OEM engineers. Jason Smith from Snap-on Diagnostics and Steve Caruso from OBD2Training.com presented a class from the service perspective by demonstrating anomalies found when diagnosing vehicle failures.

Smith presented a case study where a variable cooling fan set throttle body DTCs. This caused the vehicle to revert to a reduced power mode. All the possible causes for the codes stored and tests that they were instructed to perform due to those codes caused the technician to replace the electronic throttle control.

Smith also showed what a Google search found when the problem for the codes had been entered for that vehicle. It demonstrated the impact of what happens when diagnostics of the stored trouble codes are misleading. The wiring diagrams listed in the service information systems show no connection between the cooling fan and the throttle actuator, so the technician has no idea the systems are related. According to Smith, some of these issues can be addressed through an industry-wide effort to improve training and education.

Caruso presented a case study where a vehicle passed the OBDII portion of California's emissions test, but failed the tailpipe portion. The tailpipe was emitting black smoke and the CO reading was 7.2 percent. Parts replaced at other shops before the vehicle was inspected were: catalytic converter, PCM and front O_2 sensors. All signs pointed to a defective PCM, since there were no codes, the vehicle passed all the OBDII Monitors and was running very rich. However, after further analysis, Caruso made an interesting discovery. The front O_2 sensor, which was already replaced a total of three times by other repair facilities, was reading 800-900mV; however the rear O_2 sensor was stuck at only 100mV. The manufacturer of that vehicle did not list any service information about the rear O_2 sensor having influence or control on fuel trim. It only tested for activity that had occurred when the vehicle was started, but then tapered off until it sat at low voltage.

2015 SAE OBD Symposium Event Info for September

As a result of these discussions, Smith recommended creating a database collection of anomalies; and finding resources to get technicians and educators to better prepare themselves to deal with the more complicated systems. According to Smith, this can only be achieved by manufacturers and the aftermarket working together: "Collaboration can be more effective than competition."

Heavy-duty OBDII

The last day of the annual symposium focused on the heavy-duty industry applications. Jeffrey Potts, from Cummins Inc., gave the update on the heavy-duty Industry and some of the specific challenges they face. Of interesting note was the way the heavy-duty industry approaches remote fault isolation, which we will see occurring more often in the automotive industry in the future. Vehicle down time is much more crucial to the heavy-duty industry since the vehicles are a source of income, not just convenience.

The next OBD symposium

The SAE 2015 On-Board Diagnostics Symposium will be held Sep. 15-17 at the Indianapolis Marriott Downtown in Indianapolis, Ind. The Monday before the event begins, John Van Gilder from General Motors will conduct a one-day course, "Emissions-Related OBDII Systems: A Design Overview." The course covers topics including fundamental design objectives for OBDII systems, basic design features, defining "good" vs. "bad" systems and anatomy of an OBDII. I had attended the class two years ago and gained a new and valuable perspective on OBDII systems from it.

In addition, symposium organizers such as Gruszczynski will be looking to continue to add focus on the serviceability aspects of OBDII to future events. As noted, the increased system complexity added via electrification and other new technologies required to meet ever-more stringent emissions regulations will place a larger burden on the service community. The knowledge exchange provided by the SAE OBDII Symposium is a great starting point to ensure that engineers and technicians share the same understanding of those systems and technologies

If you are interested in joining SAE, you can become a member at www.sae.org. If you would like to attend this year's OBD Symposium in Indianapolis you can register at MotorAge.com/SAE2015.


MICHAEL MILLER
CONTRIBUTING EDITOR

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.

E-mail mmiller7290@gmail.com

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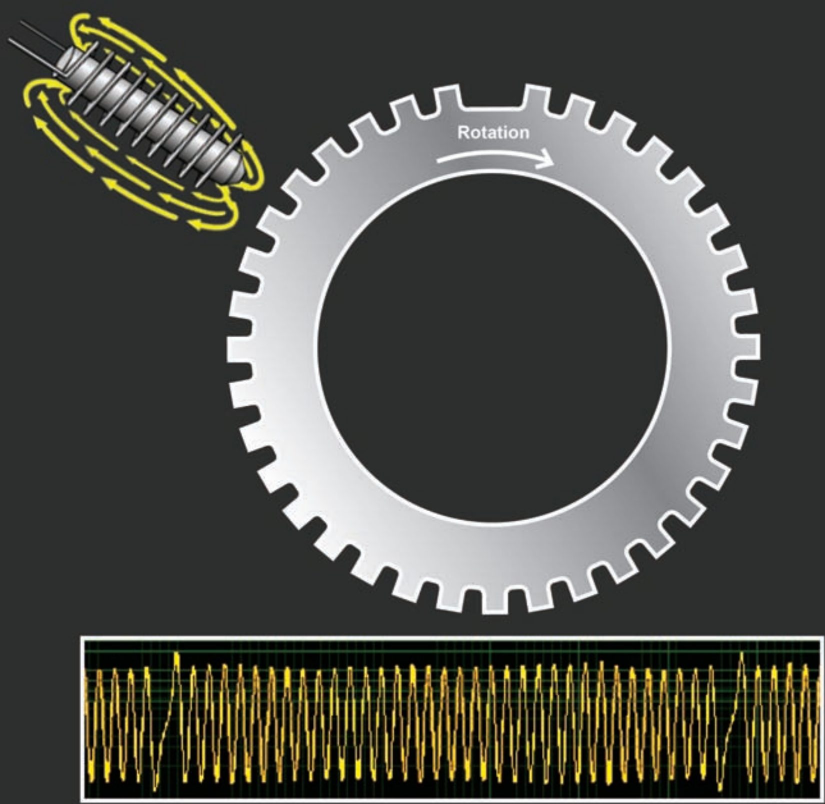
Figure 1



GETTING SYNCED

TIMING IS EVERYTHING!

BY **BERNIE THOMPSON** | CONTRIBUTING EDITOR

As one goes through life, it is said that timing is everything. In the case of the internal combustion engine, this could not be truer. In order for the engine to operate correctly, the event timing and event sequence must be correct. This means the location of the crankshaft and camshaft positions must be known, as well as their relationship to one another. So the physical position of the crankshaft and camshaft must be known.

In order to determine where in space these shafts' physical positions are a sensor will be used. A sensor reads the physical quantity and converts this to an electrical signal. This physical quantity or shaft position of the crankshaft and camshaft will be determined with sensors that send an electrical output signal. This output signal will be produced with the interaction between the trigger wheel and the magnetic field of the sensor, as seen in Figure 1. This type of sensor is known as a variable reluctance

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sensor, but sensors that rectify this analog voltage will also be used; rectification of an analog signal means that it is converted to a digital signal or square wave. The trigger wheel is mounted on the shaft and will have some type of indexing means, such as a missing tooth, so the shaft's orientation can be calculated. If the engine is rotating, the interaction between the trigger wheel and sensor will produce a waveform or a voltage that changes over time.

The internal clock

The voltage change produced from a sensor is just that, a voltage change. In order for the Engine Control Module (ECM) to be able to interpret the voltage change, a program must be written. The ECM microprocessor uses an internal clock to run with the software so that the shaft's position can be calculated. This clock produces pulses that set up the rate at which tasks can be carried out. Each clock pulse sets up a machine cycle that caches the registers that carry out the programming tasks. Clock speed refers to the number of pulses per second generated by an oscillator that sets the tempo for the processor. Clock speed in the automotive computer is usually measured in megahertz (MHz), or millions of pulses per second. In order for the microprocessor to work accurately, the clock will need to have a high oscillator stability, so a quartz crystal oscillator circuit is used.

The quartz crystal used in a quartz crystal oscillator circuit is a thin, small piece of cut quartz. At the ends of the cut quartz, the surfaces are metallized in order to attach electrical connections. When producing the quartz crystal, the size and thickness are important because it affects the fundamental frequency of oscillations. Once the quartz crystal is cut and shaped, the crystal cannot be used at any other frequency. In other words, its size and shape produce an oscillation frequency that is directly proportional to it size.

When a voltage source is applied to the quartz crystal, it begins to change shape, producing a characteristic known as the Piezoelectric Effect. This Piezoelectric Effect is the property of a crystal by which an electrical charge produces a mechanical force by changing the shape of the crystal and vice versa; a mechanical force applied to the crystal produces an electrical charge. This Piezoelectric Effect produces mechanical vibrations or oscillations that will directly change the voltage. It will be necessary to maintain a very accurate constant supply voltage on the quartz crystal so that the frequency output is maintained. This quartz clock circuit will send a continuous stream of square waves that will set the master clock and system timing within the microprocessor.

This master clock is built into the hardware of the microprocessor. The program that runs the engine is part of the software that is running on the hardware of the microprocessor. The software uses this hardware clock to carry out the instructions that will allow the microprocessor to set up the timing sequence for the internal combustion engine. This is accomplished by the crankshaft position sensor's electrical signal. The signal is monitored by the software so the crankshaft position and velocity can be calculated. By having the crankshaft sensor indexed, the position of the No. 1 piston can be calculated, and this will allow all of the piston positions to be set by the mechanical configuration of the crankshaft. Additionally, using the clock and the sensor to monitor the rate at which the crankshaft is changing will provide the velocity or speed that the crankshaft is rotating. On a four-stroke engine, the crankshaft rotates two times to complete a fire cycle. This means that the piston is at Top Dead Center (TDC) and Bottom Dead Center (BDC) twice for each fire cycle. By using the crankshaft position sensor, one can calculate the position of the crankshaft and know if the piston is at TDC or BDC. However, with this limited information, one cannot calculate which of the four strokes (intake, compression, power, exhaust) the crankshaft is on. Since the piston is at TDC on compression and exhaust, it will be difficult to calculate which of these strokes the

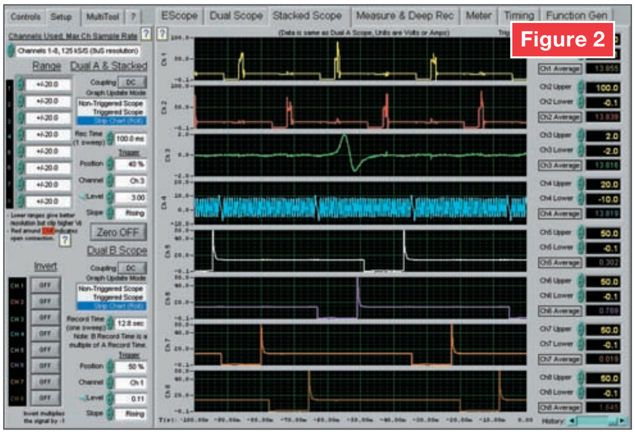

Figure 2

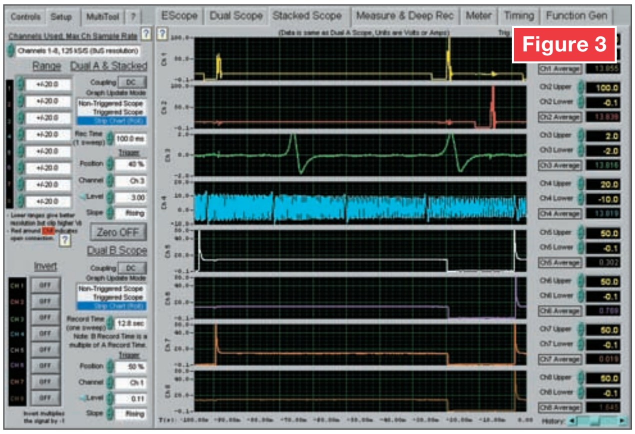

Figure 3

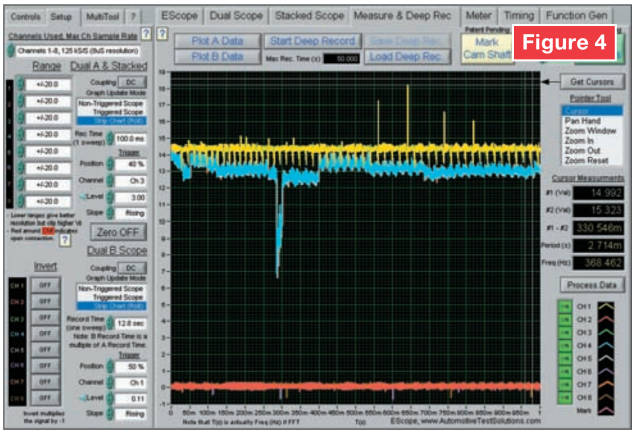

Figure 4

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Please visit us at www.kyb.com to learn more engine is currently on. In order to calculate the crank angle space, a second sensor will be needed; this sensor is the camshaft position sensor. The camshaft position sensor will allow one to calculate which stroke the crankshaft is currently on. By using the software to compare the crankshaft to camshaft position, a timing sequence can be calculated.

Running in harmony

The microprocessor and software work together to operate the internal combustion engine. It is critical to have these two components work together to set up the timing sequences. These timing sequences will provide the operation of the ignition coils and the operation of the fuel injectors. The ignition spark event will need to be timed to the crankshaft rotational position and crankshaft rotational velocity. This spark event will ignite the air/fuel mixture within the cylinder. Since hydrocarbons comprise the fuel stock, there is a set amount of time to burn these. This burning of the fuel stock is a chemical reaction occurring between the hydrocarbons and oxygen. The reaction between these components will take a set amount of time to complete. It will be important to start the reaction at the correct time so that the majority of the reaction is completed by the time the crankshaft reaches the 90-degree point after TDC. This is the point at which the piston has the best leverage position to push the crankshaft around, thus producing the best torque. As the crankshaft velocity increases, the reaction start time between the hydrocarbons and oxygen will need to happen earlier. This in turn will allow the maximum pressure from the reaction to be built by the 90-degree point. This is why the ignition timing is advanced as the engine speed increases. If the spark event is too early or too late, the engine efficiency will drop.

The operation of the fuel injectors is also a timed event. On the port fuel injection system, the injector is opened when the intake valve is in the closed position. This usually occurs when the engine is on the exhaust stoke. The injector spray is directed at the back of the intake valve since this is the hottest part of the induction system. When the injector is opened, it sprays the fuel in an aerosol format, or as small liquid droplets suspended in the air. These small droplets can take heat energy on more rapidly from the intake valve, thus flashing the liquid fuel into a fuel vapor. If the injector delivers the fuel too early, the fuel vapor at the intake valve pocket can be pulled to another cylinder that is currently on an intake stroke. This will allow an imbalance of fuel from one cycle to the next cycle, which can affect the combustion efficiency and emissions of the engine. If the injector delivery is too late, all the fuel may not vaporize, which may also affect the combustion efficiency and emissions of the engine.

Putting it to work

Now that an understanding of the engine timing events has been established, let us look at Figure 2. This is an oscilloscope reading of a good 4-cylinder port-injected engine where the ignition events are shown at the top of the screen, channel 1 (yellow) and channel 2 (red). The camshaft position sensor is on channel 3 (green), and the crankshaft position sensor is on channel 4 (blue). The fuel injectors are on channels 5 (white), 6 (purple), 7 (orange), and 8 (brown). It can be determined that the timing sequence events are occurring in order. The ignition coil packs are a waste spark system and are firing in sequence one after another in order, each coil firing on one crankshaft revolution. The camshaft and crankshaft signals are in time and have no breakdown occurring. The fuel injectors are firing in sequence with the proper injection on time.

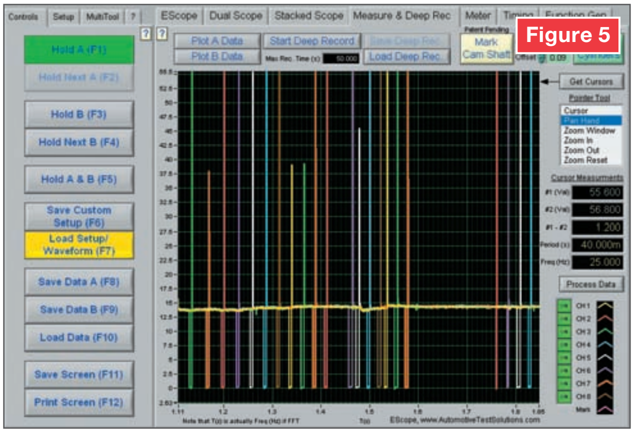
Figure 5

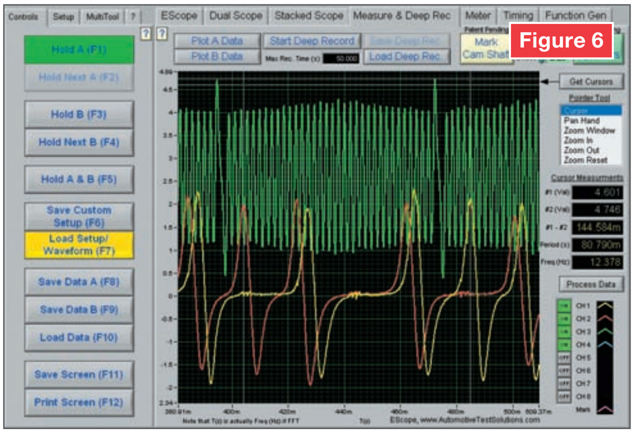
Figure 6

In Figure 3, the same engine is having a drivability issue. The oscilloscope capture was taken during an intermittent failure. This vehicle had to be driven for 30 minutes to an hour before a "very brief" cut out occurred. As can be determined, the timing sequence events are not occurring in order. The ignition events at the top on channel 1 (yellow) and channel 2 (red) have multiple ignition events missing. The camshaft position sensor on channel 3 (green) and the crankshaft position sensor on channel 4 (blue) are in time and have no breakdown occurring. The fuel injectors on channels 5 (white), 6 (purple), 7 (orange) and 8 (brown) are no longer in sequence. These fuel injector events are aligned and the injection on time is commanded for a longer time interval.

The question now is what is occurring with these timing sequence events. Perhaps the most important part of these sequences are the fuel injectors. These fuel injector events are timed sequence events, but during the failure, these events have lost their sequence. The injector events are occurring in a bank fire mode where all the injectors are command on at once. Additionally, the fuel injection on


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time has been increased as well. This sequence is what happens when one first starts the engine. When starting the engine, the microprocessor does not know where the crank angle space is so it bank fires all the injectors at one time. This strategy insures that the cylinder will have fuel in it when the spark sequence can be calculated by the microprocessor. Once calculated, a spark can be delivered to the air/fuel mixture within the combustion chamber, thus igniting it. When the engine is first started, more fuel is needed to make a combustible mixture within the cylinder. This additional fuel will wet the induction port, valve and chamber and is the reason the fuel injector on time has been increased.

> **"The software timing is accomplished with the crankshaft and camshaft position sensors. If the sensors are not in the correct location for the program to calculate their position, an error within the program occurs."** – Thompson

When the timing sequence events occur like these, the microprocessor is in a reset mode. When a reset mode is activated, the program no longer knows where the engine's crank angle space is, so it carries out the task of a first-start sequence. This problem will be associated with the microprocessor's quartz crystal oscillator circuit. When the clock goes down, the program will restart, causing a reset to occur. This problem can be caused by the powers or grounds to the ECM, an ignition coil that is shorted between the primary and secondary, or can be an internal computer failure. Since the ignition coils have already been checked and are good, one must check the other possibilities. To determine which of these is causing the problem, the powers and grounds to the ECM will need to be monitored during the failure. If no problem occurs on the powers or grounds, the problem is internal and the ECM will need to be replaced. In Figure 4, the oscilloscope is connected to all the powers and grounds at the ECM. The vehicle was then driven until the problem reoccurred. The scope capture shows the powers and grounds being monitored. As can be seen, the power is failing for about 3 milliseconds on channels 4 (blue) and 5 (white) to the microprocessor. This very quick power interruption affects the quartz crystal oscillator circuit causing a computer reset to occur.

Now let us examine another engine exhibiting a drivability problem. In Figure 5, an 8-cylinder port-injected engine injectors are shown. On this oscilloscope capture, the injectors at the left of the screen are in sequence. The oscilloscope channel colors represent the engine's injector sequence events. The injector sequence is green, orange, red, purple, white, blue, brown, yellow, and then returning to green. As you continue across the screen you will see a break in the timing where the red injector event is present followed by a pause. After the pause, the purple then follows, showing the sequence is not broken. Again the injector events continue until the orange injector event is followed by a much larger pause. After the pause the red injector event occurs showing the sequence again was not broken. These pauses create a problem where no fuel is injected to the cylinder in the engine, thus creating an engine cut out.

The question now is what is occurring with these injector timing sequence events? It is clear that the injectors are not being activated correctly; it is also clear that the injector event sequence remains intact. This is caused by a software timing error where the algorithm written for the sensor events does not correlate with the actual sensor positions. The software timing is accomplished with the crankshaft and camshaft position sensors. The program uses the microprocessor's clock to calculate the crank angle space. If the sensors are not in the correct location for the program to calculate their position, an error within the program occurs. This programming error can create many different timing sequence failures depending on how the program instructions are written.

In Figure 6, the oscilloscope capture is from this same 8-cylinder engine and shows the camshaft position sensors on channel 1 (yellow), channel 2 (red) and the crankshaft position sensor on channel 3 (green). It can be determined that the two camshaft position sensor waveforms are not in the same position compared to the crankshaft position sensor. The red camshaft position sensor waveform is 3.5 teeth after the missing index tooth on the crankshaft position waveform. The yellow camshaft position sensor waveform is 5 teeth after the missing index tooth on the crankshaft position waveform. The red camshaft position signal at 3.5 teeth is in the wrong position. This mechanical timing problem causes the program to be unable to correctly identify the crank angle space, thus creating an injector timing problem.

It is important to understand how the timing sequence events are created, so when a problem occurs one can quick identify the cause. Pay particular attention to the way these output signals fail. It is not that they failed, but the exact way in which they failed — did the sequence fail, did the commanded time fail, or was a command issued? These are the output commands that when incorrect are caused by input errors, software errors or electrical supply errors. Each of these different errors will change the commands in different ways. By monitoring the timing sequence events, some of the most difficult problems will become routine in your service bay.

BERNIE THOMPSON
CONTRIBUTING EDITOR

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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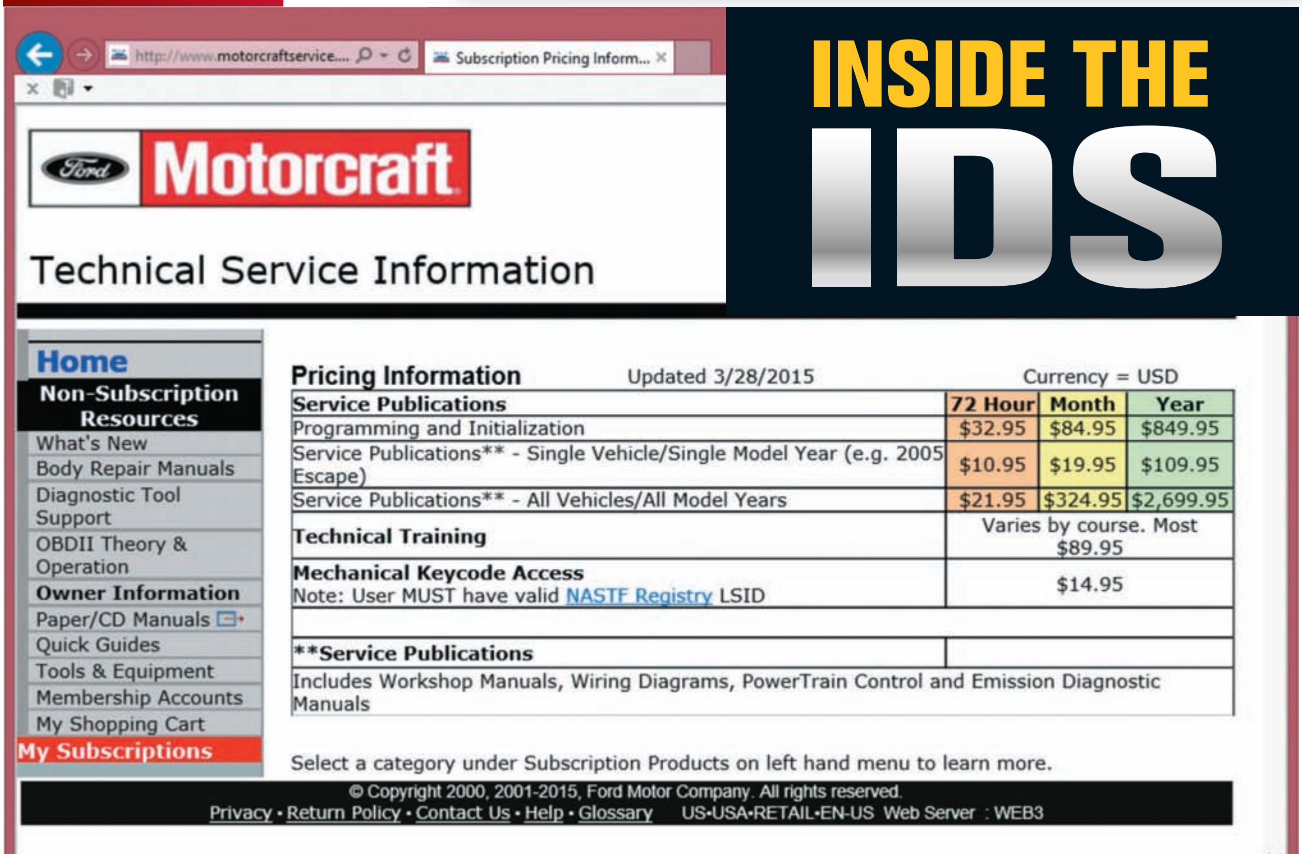
↘ DRIVABILITY

INSIDE THE IDS



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A GUIDE TO USING FORD'S OEM SCAN TOOL

BY **MARK DEKOSTER** | CONTRIBUTING EDITOR

Ford's IDS scan tool may be one of the most powerful tools for working on Ford vehicles that you can own. There are some very good aftermarket tools, and as an independent shop you probably have one or more of them. Yet owning the factory tool still has advantages as they have capabilities for programming, calibrating and bi-directional control that your aftermarket tool likely does not. Making the decision to buy one of these tools is a business decision that only you can make.

Overview

For those of you who have the IDS or access to it on a regular basis, you know that Ford has brought out an updated interface called the VCM II. They have also gone to a subscription fee to use the tool to connect to a vehicle. Without a subscription you can still use the software to review a recorded session, but you can't interface with a vehicle. As of this writing the cost to purchase a subscription is $699 per year per VCM or VCM II. The subscription does include programming and calibration files.

Much has been written and recorded about the basic use of this tool; therefore, we will only touch on that to get to the main topic of this piece and that is how to use it more efficiently. One more caveat — this tool changes regularly. Ford sends out a major revision of the tool software four times per year that adds functionality, additional information about calibrations and/or new testing procedures.

Some of these changes are driven by the increased capability of the onboard computer systems and their networks in the vehicles. Most of these tests are backwards compatible. I remember a revision sometime back when they changed the number of PIDs recorded in Freeze Frame. Going from the seven or so that were recorded to… well I've never bothered to count, and they are

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on more than one screen so you need to scroll to see them all.

Another revision that many don't know exists is the way that Ford has remade its PTS website to interact with IDS. Ford has programmed the tool to be accessed by their service information site PTS. You can subscribe to PTS through motorcraftservice.com. You will still need to have IDS installed on your computer with a valid subscription for the tool.

With access comes the ability to connect to the car and to the PTS website. You will need to be connected to the internet during this procedure. When road testing the vehicle, you will need to use the IDS program that is on your computer or use the VCM II – CFR, Customer Flight Recorder.

When you connect to a vehicle via the PTS website, you will get information tailored specifically to the vehicle and the concerns of the one that is sitting in your bay. The OASIS report will come up and give you background information about outstanding campaigns that may be on the car. It will give you any Technical Service Bulletins (TSBs) or Special Service Messages specific to the vehicle and Diagnostic Trouble Codes (DTCs) or concerns that you input.

Going to the TOOLBOX gives you the ability to see the vehicle's network system and DTCs by module. What you will see is the network topography of the vehicle you've connected to. Modules that are on the network and responded to the IDS will show in green or yellow. Green is good; yellow indicates that the module has a DTC in memory.

Gray module indicators are modules that did not respond when they were pinged during initial connection to the vehicle. These modules are optional equipment modules and may be non-responsive or may not be equipped on the vehicle you're working on. You will need to determine that on your own if you are working on a vehicle, and the concern may be related to one of these optional equipment modules.

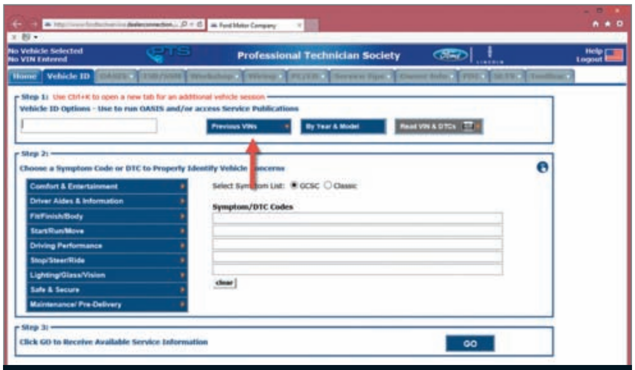
It is important to note that IDS connects to the vehicle you're working on. It does not simply connect to any and all 2012 Focuses, but the one in your bay. Both the web version of IDS and the installed version on your laptop connect to the unique vehicle in your bay.

If you review the network topography image, you can see that you get a listing of the DTCs and if you highlight the DTC you get the definition and some additional information about the code.

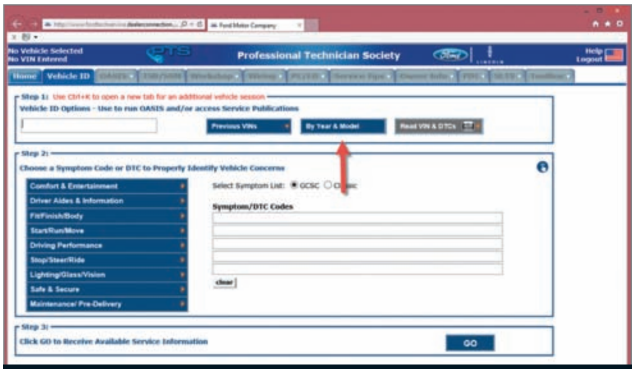
Select the next tab on the display: Part Number Summary. This brings up a screen that gives you whether or not the module responded, optional or not, DTCs, assembly part number and software part number. This may be valuable when talking to the Ford dealer parts department to help make sure they get the correct part for you.

Selecting the next tab on the screen, Network Monitor, opens a new window and will allow you to run a live network test on the vehicle. The website will ping the modules on the vehicle and as long as they respond, they will stay green. If they don't respond, they will turn red and tell you how many pings were missed. You can deselect any optional modules that are not on the vehicle so you do not end up with a series of red boxes that don't help you with analysis.

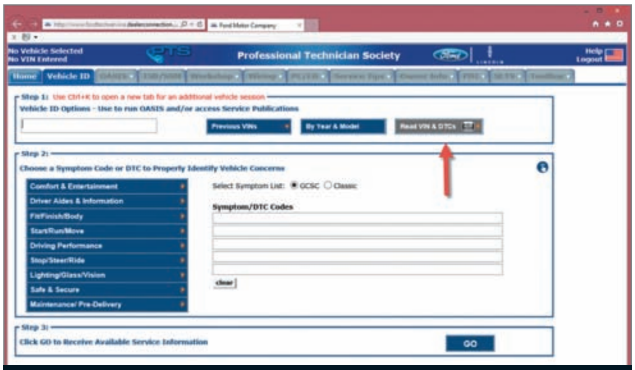
If you have a vehicle with a possible network concern, you can activate this network test and then do the traditional Ford Wiggle Test and see if any of the modules go offline or come online. Using this topography with the wiring diagrams



When you have logged into PTS and select the Vehicle ID tab, you are given three options for identifying the vehicle you're working on. You may select previous VINs.



Or you may select By Year & Model.



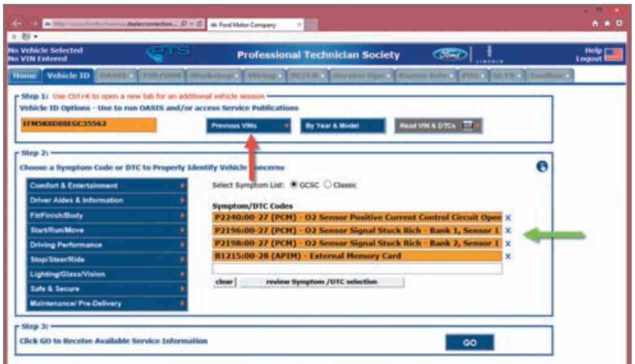
Or you may select Read VIN & DTCs using the IDS.

may also help you narrow the concern and its location by knowing which modules can talk and which can't.

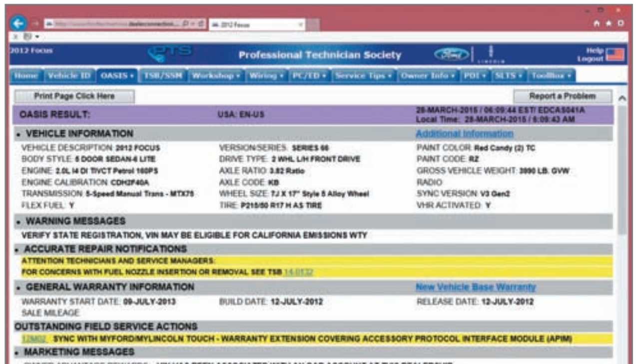
Data display

While you are connected to PTS and to the vehicle, you have all of the same functionality of IDS available to you. The added features that are yours with IDS and PTS kick it up a notch. Let's look at how.

When you open the Datalogger tab and go into any module, especially the Powertrain Control Module (PCM), the screen that comes up is a bewildering display of Ford acronyms and



This image shows selecting by Previous VIN and the session you see that may be accessed is one with four DTCs. This was a 2014 Explorer. Like IDS, the PTS website retains previous sessions. To reopen this session, click on the GO tab.



When using PTS and the IDS or if you input the VIN manually, the next screen you see will be this OASIS screen showing information about the vehicle. This 2012 Focus has several notices of interest to a technician highlighted in yellow.

may require you to scroll to see them all. Some of them are dark gray and some are light gray. Those that are dark gray are preselected for you. I'm not sure who made those picks, sometimes I find them to be the ones I want, often I don't.

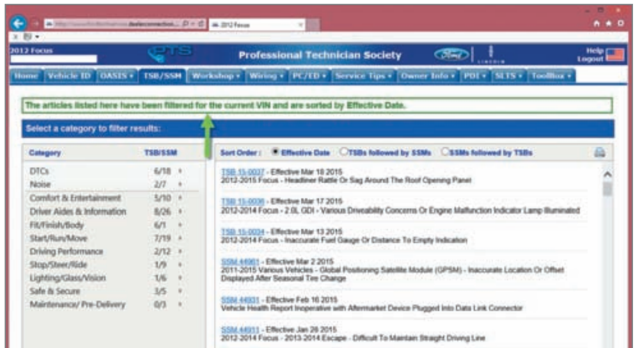
When you click on a Parameter Identifier (PID) its definition shows up in the box at the bottom of the screen. These screens of PIDs are often where you will find the changes that come with the updates to the tool. You get more of them. Of course we are in danger of data overload, but I'd rather have trouble deciding what not to look at than wish I had more options to choose from.

Because IDS is PC based, you have many options for the way you display your data and how much data can be displayed. There is a limit to the number of PIDs you can display and when you hit that limit, IDS will turn the selection screen red.

You can also modify the way IDS displays data. It can display it as a histogram that leaves a trace wherever it has been. It can display it as a bar graph. It can display as a digital meter, and it can display as XY plot.

Some PIDS may not have all of the options, as they may not be suitable for certain types of displays, or rather you may not want to use certain display functions.

PIDs that have the # symbol with them are bi-directional controls or Output State Controls, as Ford calls it. These PIDs may be selected and allow you to control certain functions to



Selecting the TSB/SSM tab will give you a listing of TSBs and Special Service Messages filtered by the VIN and date.

assist with analysis of concerns.

You can also set parameters on PIDs that will alert you to when their values go beyond preset limits. For example, you may have concerns of the system voltage going low. You may select the VBAT PID and place a limit value on it. If the voltage drops below, goes above or goes outside your parameters, the IDS will do one of two things — it will make a recording or it will beep at you.

PIDs that have limits set on them also change color. They will be green when they are operating within the limits you put on them, and they will change to red when they exceed those limits.

What does all this mean to you?

I don't know about you, but the closest I've come to getting in an accident while road testing is watching the scan tool while driving. I prefer to watch and have another drive, but that doesn't always work out. People think texting and driving is a problem; technicians and scan tools are even more disengaged. So what to do? Using this preset option allows you to drive and then stop and see if you have any recordings. If you don't, the values did

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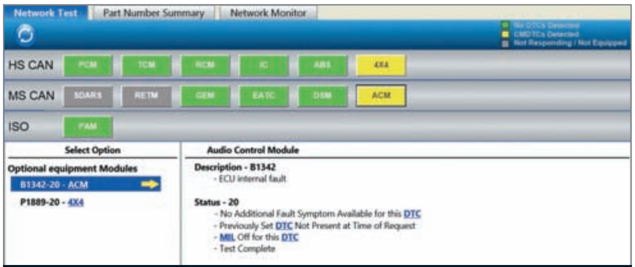
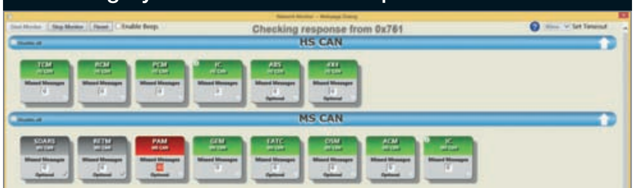


This is the network test showing the modules that the vehicle may be equipped with, the ones that responded and two with DTCs. This is from a 2012 Focus.

When you select the network test that will ping the modules via the PTS website and IDS interface, this is the explanation screen that is shown first.

As the test starts, the modules are in green that originally responded during initialization of the session. The two gray modules are non-responsive.



You will note that the Parking Aid Module (PAM) has gone from green to red. This module has an intermittent concern. The other non-responding modules will also turn red as they are pinged and don't respond, including modules that don't respond because they are not on the car.

not exceed or go below what you were concerned about, and you can look at other concerns or different sets of PIDs.

Of course, all of this takes time, and whenever I talk to technicians they are always worried about time. Whether or not you should be is the topic of another article, and I don't want to suggest that doing things in a timely fashion is not important.

Wouldn't it be nice, then, if you could simply click on an icon and select a set of PIDs that you had already modified? The answer is a definitive YES! With IDS you can.

We all know that for most common concerns there are certain PIDs that we monitor to try and confirm our hypothesis of what might be wrong. For driveability concerns, Ford has a list of recommended PIDs based on the symptom. These are found under Pinpoint Test Z, and I wrote a previous article (*Finding intermittent faults on Fords*, June 2014) talking about how to use Pinpoint Test Z to find intermittent concerns that you may reference for help.

All of the PID displays in IDS are preset in one of four ways. These have been determined by the software designers and often have then set in ways that don't really help much. Fuel Trim is often default scaled to +35 percent to -35 percent. Seeing a 5 percent or 10 percent change barely makes the XY plot move.

None of the PIDs are preset to take recordings, yet all can be. As mentioned above, most PID selection screens have more PIDs than can be viewed at one time and have certain ones preselected. These are the things that have certain IDS users talking about how it is not an easy tool to use and the less familiar you are with it the more difficult navigating through these screens is. It is getting familiar with the tool that changes this. I have the same concern when I go to GM's new PC-based scanner.

How to customize your PIDs

This will take some time initially to set up, but once you've done it, you will be able to go into Datalogger and click on an icon, pull up a list of presets, select the one you want and then head for the highway and road test away! Here's how this works.

First take your computer, the VCM II and find a Ford. Begin an IDS session and go into Datalogger. You may wish to have Section 6 of Ford's PCED (Powertrain Control Emissions Diagnosis) manual open for help with PID selection.

Using the symptom chart and Section Six select the PIDs you would want to view for any particular concern. If there are more PIDs than you can select for a given session, then you will need to make two sets: "Rough Run 1" and "Rough Run 2," for example.

Next rearrange the PIDs and the way they are displayed to the way you want them to be. Set up any parameters that will flag or record datastream. Select the Save to folder icon and name your setup. "Rough run cold" perhaps, or "Hesitation on accel," and then give it a description.

Keep in mind that you can do this in any one of the Datalogger tabs, Engine, Transmission, etc. You can pull selective PIDs from the PCM and create an A/C heading. You may wish to create transmission ones for each of the Ford transmissions/transaxles.

One set that I would have would be "Intermittent Misfire" with the up and downstream O_2s and related PIDs for current with the wide-band sensors, and long and short fuel trims and fuel system status (Loop).

There are other ways to personalize this tool as well, each one giving you the ability to be the shop IDS guru and to go from tool startup to analysis efficiently every time. MA

MARK DEKOSTER
CONTRIBUTING EDITOR

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

E-mail Mark at mark.dekoster@gmail.com

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Figure 7

FINDING THE LITTLE ONES

TIPS ON FINDING THAT EVAPORATIVE EMISSIONS' 'VERY SMALL LEAK' SOURCE

BY **G. JERRY TRUGLIA** | CONTRIBUTING EDITOR

Since EVAP Diagnostic Trouble Codes (DTCs) are among the top codes we have to diagnose, we need a good understanding of the system. If you break the system down into small sections, it's easier to diagnose. Remember the following: the purge valve is normally CLOSED. This means with no command from the Powertrain Control Module (PCM), the valve prevents the vacuum from purging EVAP vapors from the canister. The vent valve is normally OPEN, which means without a command from the PCM, the valve is OPEN, allowing the system to flow vapors. When the EVAP system needs to test itself for leaks, the PCM closes the vent valve and pulses the purge valve to create a vacuum in the system, then closes the purge valve to seal the system for testing. The PCM has a specific amount of time programed into the test procedure that checks the system for hold vacuum or pressure, depending on the system. If the system does not leak more than the specified amount (0.010, 0.020 or 0.040 inch), the system receives a pass. It becomes our problem when the system does not hold a vacuum or pressure and illuminates the Malfunction Indicator Lamp (MIL). In this article, I will provide you with some of the principles that you need to know to be successful at diagnosing and repairing EVAP system problems, especially finding those pesky little leaks.

Your EVAP foundation

The No. 1 cause of a motorist's illuminated check engine light is a gas cap that they did not tighten after refueling. This is why some techs delete the EVAP code and tell the vehicle owner to come back for a diagnosis if the MIL comes back on. Since loose and defective gas caps are only to blame for a part of EVAP issues, when vehicles return with EVAP codes, it is necessary to properly diagnose them. When diagnosing EVAP system problems we usually just need a smoke machine that is connected to CO_2 or nitrogen (not air pressure) to move the smoke through the EVAP system. If that does not work, you may want to try the new Bullseye leak detection system from Automotive Test Solutions. Other helpful tools to have are an information system that describes the vehicle EVAP system function and components, a wiring diagram, capable scan tool, a Power Probe that can be used to activate the solenoids, and a flow-pressure gauge. In rare situations, factory scan tools might be necessary in order to test vital EVAP components. We are going to take a look at a few different ways to diagnose the EVAP system to assist you in finding small leaks.

Before we move on, it is important to understand and interpret pressure readings since information systems provide so many different measurement specifications. The chart provided (**Figure 1**) will help you convert the specification from the information system to the tool

Photos: G. Jerry Truglia

you're using. Since you may be working with different units, it's important to have the conversion chart. You can compare actual system pressure to the Fuel Tank Pressure (FTP) PID to aid with your diagnosis. Just remember to add 14.7 psi to all low-pressure gauge measurements when comparing it to the scan tool (they are calibrated to atmospheric pressure already). If the flow gauge agrees with the scan tool, then we can base our diagnosis off of the scan tool PID.

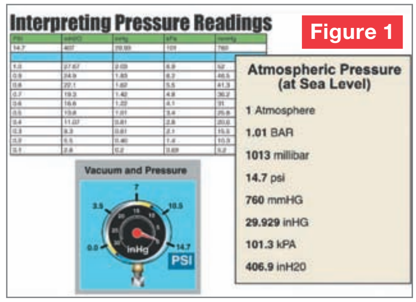
Some test using vacuum

You need to have a good game plan when trying to diagnose and locate the small leaks. The first step is always to understand the system by reading up on the system components and component location, along with the strategy of the system. This step is very important, since there are so many different systems that have different operating strategies. The following information is the fundamental information on what you need to know about most EVAP systems. Make sure to always identify and read up on the EVAP system you're testing so you know what to expect from a particular system.

Let's start with EVAP systems (**Figure 2**) that use engine vacuum to check for leaks. Since this is the most common system, you need to be familiar with it to be able to perform a proper diagnosis. 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 computer monitors how long the system retains sufficient vacuum.

The simple leak detection strategy for vacuum-based systems has three basic stages.



1. System at Rest — Pressure Equalization
2. Weak Vacuum Test — Pull an Initial Vacuum
3. Small Leak Test — Hold Vacuum

Step One: System at Rest — Pressure Equalization

In this step, the EVAP system is at rest. In other words, the purge valve is closed and the canister vent valve is open. This is the normal state for each valve, before the PCM activates them. With the purge valve closed, no engine vacuum can reach the canister and with the canister vent open, any pressure or vacuum in the system equalizes with atmospheric pressure. When using a standard gauge to compare values to those shown on the scan tool, be sure to correct for atmospheric pressure. Most tools are already calibrated to include the 14.7 psi as their "zero" point.

Step Two: Weak Vacuum Test — Pull Initial Vacuum

Here, the canister vent is closed and the purge valve is opened by a pulsed electrical signal from the PCM. Vacuum in the EVAP system should increase to about 6-8 inches of water (check the pressure charts – that isn't much!) if there are no large leaks. This is sometimes referred to as the Weak Vacuum Test. If the system cannot be drawn down to this level, a P0440 is stored.

Step Three: Small Leak Test — Hold Vacuum

The purge valve is closed and the canister vent remains closed. If there are no leaks, the vacuum generated inside the EVAP system should hold steady (some small amount of decay is allowed, however, and may be caused by increased vapor pressure, not a leak). If the vacuum does not hold within an acceptable range, a fault is recorded by the EVAP monitor.

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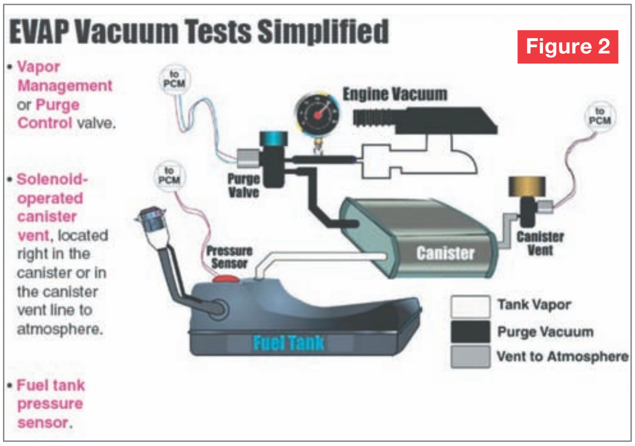
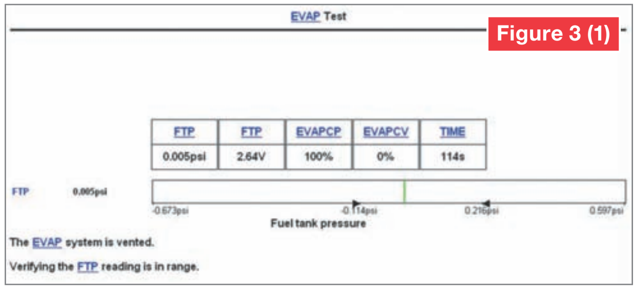
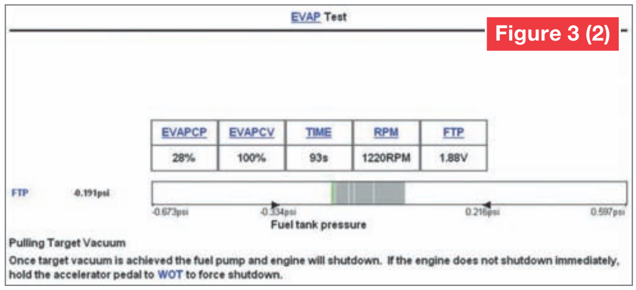
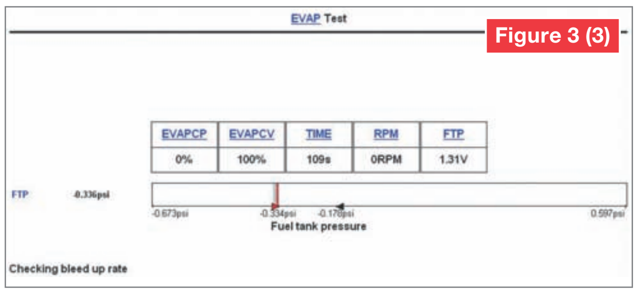
The screen shots (**Figure 3, sub 1-5**) from the Ford IDS are examples of how the EVAP system tests and runs the vehicle EVAP Monitor. Reviewing the Ford IDS scan tool screen shots will provide you with a good understanding of the vacuum EVAP system and what the OBD II system is looking for. All manufacturers perform similar tests to set and test the EVAP Monitor. If you are not working on a Ford or don't have the IDS scan tool, you can use a meter, labscope or scan tool to take the same measurements.

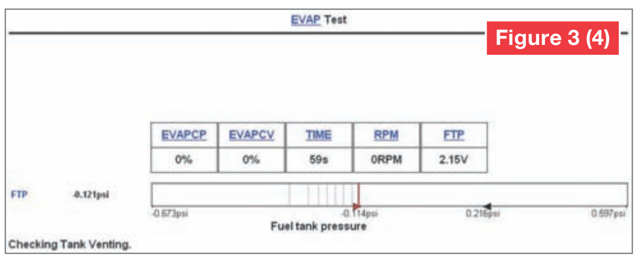
These waveforms show a Ford Enhanced (**Figure 4**) EVAP system test over a 10-second time period. Note that tank pressure falls as the purge valve opens, applying engine vacuum to the system. The Ford Fuel Tank Pressure (FTP) sensor voltage is approximately 2.4 to 2.8 volts at atmospheric pressure. Fuel tank pressure sensor voltage for this system falls to about 1.6 volts as the target test pressure (vacuum) of 7 inches of water (7"/H_2O) is reached. Then, you want to watch the rate of decay and compare it to specifications.

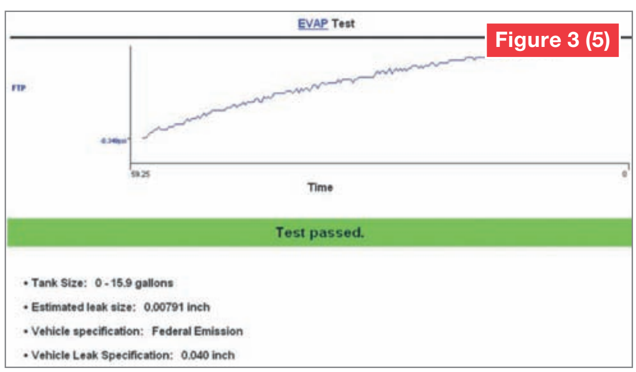












Look Closer @ TYC Fuel Pumps

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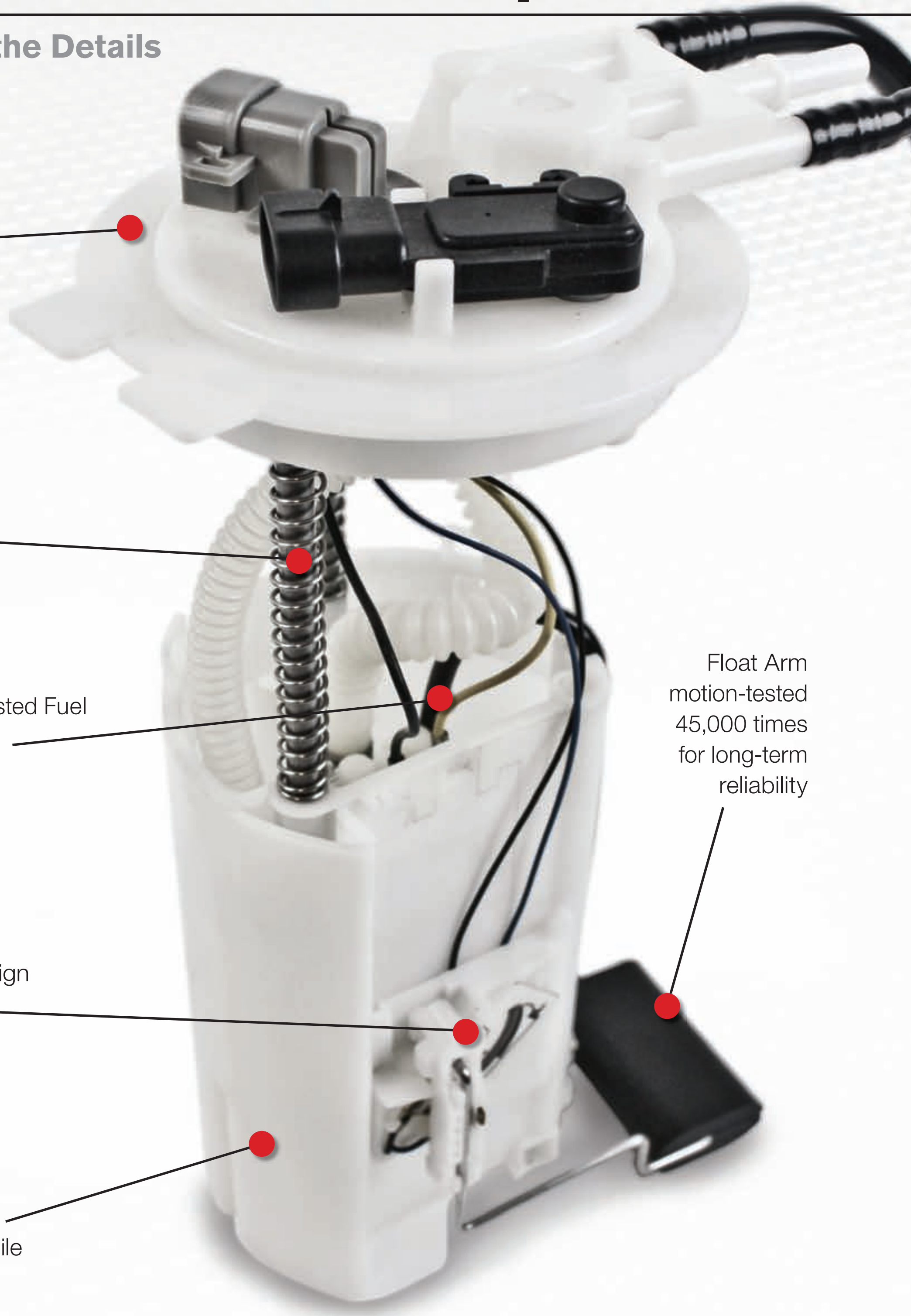

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These waveforms (**Figure 5**) show a GM Enhanced system as the EVAP monitor runs. Unlike the Ford system we just learned about previously, the pressure sensor voltage in this GM vehicle is only 1.3 to 1.7 volts at atmospheric pressure. Opposite the Ford pressure sensor, this GM pressure sensor's voltage increases as pressure decreases.

The above tests confirm whether there is a leak in the system, and proper purge and canister vent solenoid operation. You will need a scan tool with bi-directional controls or a Power Probe to open and close the solenoids.

Some use pressure

Since not all the EVAP systems utilize vacuum, we need to cover another popular system that is a bit different because it uses pressure. The following is an overview of how the Chrysler (**Figure 6**) and many other Leak Detection Pump (LDP) EVAP systems work. The procedure on how to check and test the system goes something like this. The purge solenoid is normally closed, grounded by the PCM. The feed side comes from a 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 by first energizing the purge solenoid (normally closed), followed by rapidly cycling the LDP solenoid and watching the LDP switch. The fuel at rest will increase in pressure as the fumes grow. Once pressure (7.5"/H_2O) 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 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. 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.

Before we move on it is important to remember to activate the purge and vent solenoids multiple times. In many cases after the fifth or sixth time, the valve sticks, causing the EVAP leak problem you've been trying to find with smoke alone.

Leak confirmed

Once you know you have a leak, you need to locate it and eliminate it. A number of dedicated EVAP leak detection smoke machines are available. Designed specifically for this task, they combine pressure and smoke detection to locate leaks. Most EVAP leak detection machines should include the necessary EVAP port adapters that allow you to connect the machine to vehicle EVAP test port. Remember that this port has a suggested maximum pressure of 1 psi or 28 inches of a column of water that should NEVER be exceeded. The Schrader valve has a left-hand thread, and must be removed in order for the smoke to travel properly through the system. Removing the valve will allow a free flow of test gas or test smoke into the system. If the valve is left in place, the smoke breaks up, reducing its density and making it harder to see as it exits a leak.

When using the smoke machine, you will need to select the correct test mode (orifice size 0.010, 0.020 or 0.040 inch) and start to flow a non-inert gas. Make sure to always baseline the smoke machine before attaching it to the vehicle by checking for a good flow of smoke that should be exiting the hose, along with the flow ball floating at the top of the flow gauge. This very important step needs to be followed by blocking off the smoke machine output hose while observing the flow meter ball that has to be at the bottom of the flow meter confirming that the machine is not leaking. Once the machine is attached to the vehicle, either at the test port, hose, or by the gas tank adaptor, check the flow gauge for flow. If the ball is floating over the maximum leak amount for the vehicle being tested, there is a leak present. Check for smoke at all the lines, fittings, connections, filler neck, gas tank and charcoal canister. Be aware

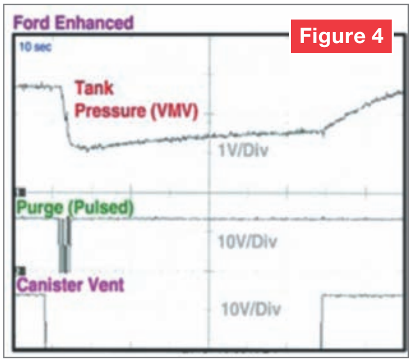

Figure 4

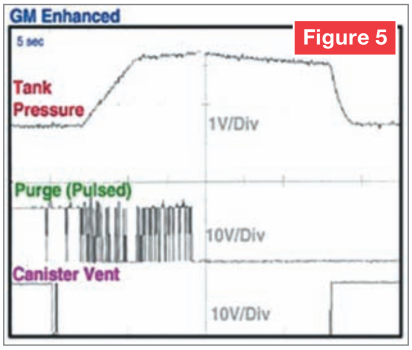

Figure 5

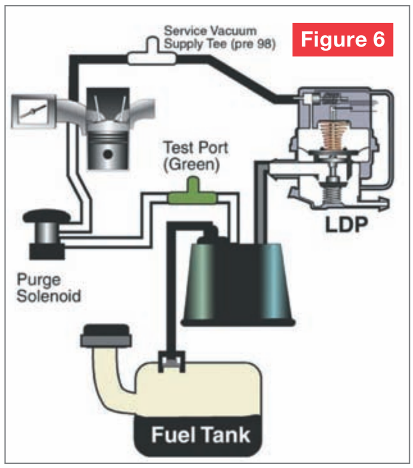

Figure 6

that in some cases the smoke or the dye will be impossible to detect. You may want to use your smoke machine along with a 4- or 5-gas analyzer to locate the leak while checking for CO_2 readings. Other alternatives are the use of an ultrasonic leak detector or soapy water while the system is pressurized with CO_2.

When the conventional leak detection systems don't work in locating the small leaks, there is a new alternative from Automotive Test Solutions. The tester that ATS has is called BullsEye and uses CO_2 along with a pressure gauge, CO_2 leak finder tester and special spray foam that is used to pinpoint the leak with a confirmation

by a change of color to the foam. The BullsEye Leak Detector accurately finds leaks as small as .001 of an inch. The system works by first charging the EVAP system with CO_2 and then analyzing the pressure stability on the gauge to determine if a leak is present along with its size. The electronic CO_2 leak detector works similarly to the "sniffer" you use when looking for leaks in an air conditioning system. It finds the area of the leak, while the CO_2 reactant foam is used to confirm the exact leak site. The foam is simply sprayed onto the leak site area where it will change color from pink to yellow identifying the problem. Another neat feature of the tool is the BullysEye Smart Control that allows control of any solenoid. We know that closing or opening solenoids can be accomplished a few ways. The easiest is bi-directional control from the scan tool, or you can use a Power Probe to apply power or ground as needed. If you are going to use a Power Probe you need to index the wiring to the connector. You will need to turn the key off followed by disconnecting the connector, turning the key to KOEO, and check what side of the connector has B+ and ground. Once you have completed those steps, you can then apply power and ground to the correct sides of the solenoid without burning out a diode (used in many solenoids). Now you won't have to worry about any of that if you have the BullsEye Smart Control activator. The Smart Control automatically locates the power and control circuit (ground) and then latches the control circuit turning the solenoid on or off. This Smart Control box takes the guess work out of where to apply B+ or ground.

Take a look at this Jeep fuel tank (**Figure 7**) that had a 0.020 leak that was impossible to find using conventional diagnostic equipment. After using the BullsEye electronic detector that located the area of the leak, I sprayed the leak seeking foam on the area and confirmed the exact location of the leak. Take a look at the picture of the gas tank and focus your attention on the area that was leaking. The area of the leak changed the leak seeking form from pink to yellow confirming that there was indeed a leak. Before using the BullsEye detection system, I used all the conventional methods that I mention in this article only to come up empty handed while the flow meter still indicated a leak. The problem with this Jeep gas tank was that it was porous. Will the current method that you're using to find small leaks find this leak? We need all the help we can get when it comes to diagnosing and finding the little ones. MA

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.

Email G. at gtruglia@tstseminars.org

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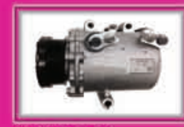

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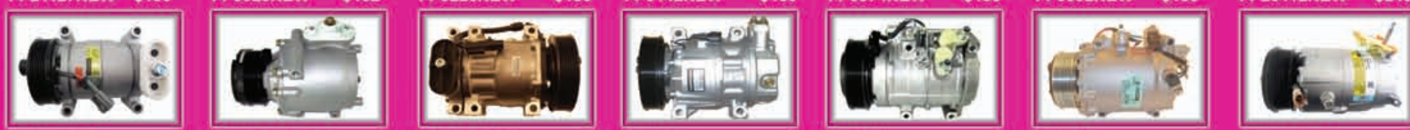

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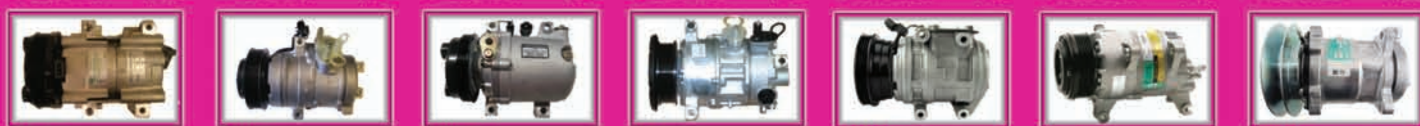

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THE PROBLEM IS NOT ALWAYS WHAT YOU THINK

FOLLOWING A GOOD DIAGNOSTIC PLAN CAN ENSURE SUCCESS, NO MATTER WHAT YOU ENCOUNTER

BY **G. JERRY TRUGLIA** |
CONTRIBUTING EDITOR

Typically when a vehicle comes in with a misfire, you use your diagnostic routine to find the problem. Most of us will interview the vehicle owner, give the vehicle a real good look over, maybe take the vehicle for a test drive, connect a scan tool to retrieve Diagnostic Trouble Codes (DTCs), check Technical Service Bulletins (TSBs) and look at a service information source. After following all the initial steps in your routine, you're going to take a closer look at the scan data. Is the misfire DTC a P0300 (Random Misfire Detected) or is it a specific cylinder DTC? Our problem vehicle, a 2005 Ford Windstar, came in with a P0300 DTC, along with a few more specific cylinder DTCs. After reviewing the scan tool misfire data and Freeze Frame, we looked into Mode $06 data and confirmed that the engine was still misfiring. Now misfires are generally not that complicated of a job, but if you are thinking this vehicle was going to be a slam dunk fix, you'd be dead wrong.


Figure 1

After confirming the misfires, we needed to find and confirm what was causing them. In my diagnostic routine, I always start with the basics. For misfire concerns, one of the first basic tests I perform is one often overlooked by most of the techs I train. The step I am referring to is a relative compression test that can be easily performed if you have a scan tool that has this feature installed. Once the relative compression test is selected, you will be instructed to crank the engine over while the software calculates the mechanical condition of the engine. If you don't have a scan tool that has this capability, you can connect your labscope to the battery positive and negative terminals while setting/coupling your labscope to AC volts, or by connecting an amp clamp to one of the battery cables followed by disabling fuel and cranking it over for 20 seconds or less. If all cylinders pass, you have ruled out a mechanical problem that is causing a loss of compression. Installing a new mass airflow sensor, oxygen sensor, spark plugs, coils or any other parts for that matter will not repair a mechanical problem. We covered our usual list of basics without finding an answer so the visual inspection came back into play. When we took a closer look under the hood, we noticed that the cowl grill was loaded with leaves (Figure 1) and other debris. Take a guess what component is in the same area? If you said the Engine Control Module (ECM), you'd be right! We also found that the area around the ECM next to the strut tower looked damp. After further inspection, we decided to remove the cowl and found

Photos: G. Jerry Truglia

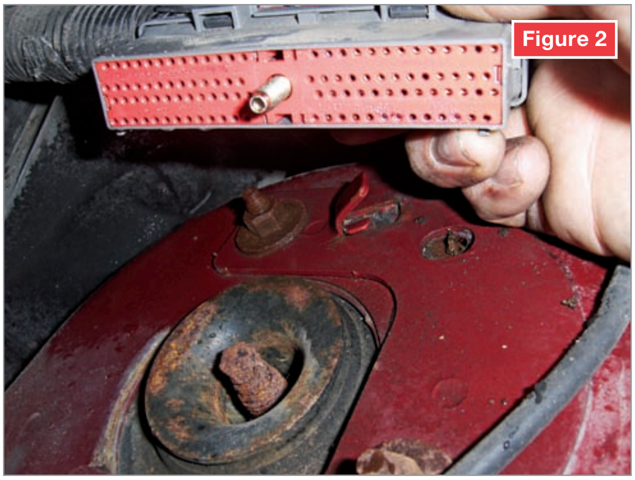


Figure 2

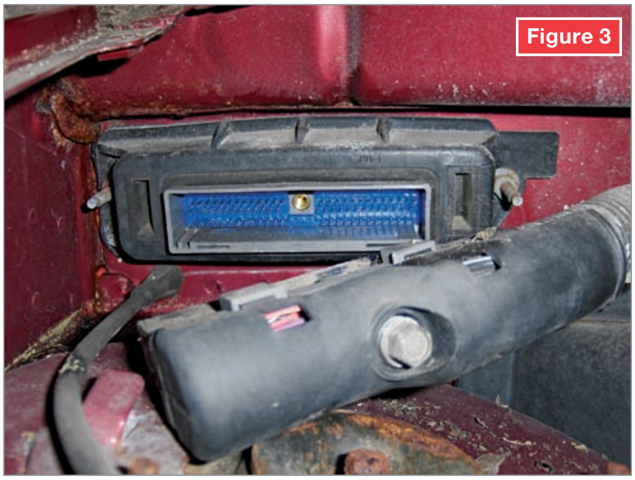


Figure 3

it flooded with water. As you can see from the picture (Figure 2), the water was finding its way into the wiring harness of the ECM. We removed the connector to the ECM and found water drops on the terminals and pins (Figure 3), ultimately turning out to be the cause of our misfire problem. After cleaning all the leaves and debris from the cowl area, we blew out the wiring harness and the ECM connectors, then applied Stabilant 22 contact enhancer to the connectors and pins. After correcting what we had found so far, we started up the engine and were rewarded with a smooth idle, free of misses.

The next step was a test drive, followed by a recheck for DTCs, pending DTCs and Mode $06 misfire data to make sure we resolved the problem. We wanted to make sure that this problem would not reoccur, so we took one extra step — installation of a plastic cover over the ECM wiring harness. The cover will prevent water from leaking down from the cowl grill if the drains become clogged again. We suggested to the vehicle owner to make sure they check the cowl area for leaves and other debris on a regular basis.

No heat

A 2011 Dodge Nitro came in with a no heat concern, and that's something you do not want to experience during the abnormally cold winter we just had in New York. This Nitro only had about 30,000 miles on it, so the diagnosis and repair for this vehicle should be a breeze. With heavy snow and cold weather, the vehicle owner thought he would save time and bring the vehicle to the dealer in his neighborhood. The dealer suggested and performed a cooling system flush along with replacement of the blower resistor. The owner told us that the Nitro was working great for a couple of weeks before it stopped working again. When he called the Dodge dealer to inform them that he had the same problem he brought the vehicle in for they told him that they could recheck the vehicle next week. As you can imagine, this did not sit well with the owner, especially with temperatures down in the single digits. When it's cold out, heat is not an option — it's a necessity!

Since this vehicle owner had a good experience with repairs I had performed on his Range Rover, he traveled out of his way to bring this Dodge in to my shop for repair. We checked the cooling system and found that it was working at normal operating temperature, along with the heater hoses that felt hot. When I went to change the blower fan speed, I noticed the blower was not working. I believed that this was the cause of the no heat problem. Maybe this problem was intermittent, so I turned the heat and blower on and off, trying to duplicate the problem. The owner provided me with the dealer invoice that had information on the cooling system service and a blower resistor that had been replaced. Since the blower resistor was replaced, we decided to start our testing there. The resistor is a sealed unit that has been a problem on Chrysler products, but the chances of both the original one and the replacement being bad is slim.

We started by checking the load first so we could eliminate that component and concluded that the blower motor was working as it should. We continued to check all the component wiring in the circuit to make sure that they were operating properly. During this procedure, we found a drop in voltage on the wire terminal connectors that were connected to the new dealer-installed blower resistor. I had my tech remove and install the harness connector a few times to make sure the connection was tight while cleaning the terminals at the same time. In addition, I had him apply Stabilant 22 contact enhancer to the blower resistor terminals. This simple step was all that was needed to restore blower motor function, proving that following a good diagnostic plan will lead to a successful repair and in this case, have heat when it's really needed.

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.

Email G. at gtruglia@tstseminars.org

PASSING INSPECTION

JUST WHEN YOU THOUGHT YOU HAD IT ALL FIGURED OUT

BY **EDWIN HAZZARD** | CONTRIBUTING EDITOR

Working as a mobile tech for the last 20 years, I have had a lot of strange but exciting repairs. Using the word exciting might be a little strange to some of you, but along with this job comes a lot of challenges. The challenge to be able to quickly and efficiently solve the problem is what makes it exciting. It's also exciting that when a job is a tough one it usually is a job that I learn from. In a lot of ways, these jobs are how we as techs get our training.

You really get to know the system and how it works when you spend a good amount of time analyzing, reading and testing the circuit or circuits at hand. Fortunately, making those sacrifices and spending extra time on jobs of this type is what will enhance your skills and knowledge for the next tough job.

VEHICLE STATS

2003 CHEVROLET IMPALA
Vehicle Year/Make/Model

120,639
Mileage

3.8L V6
Engine

AUTOMATIC
Transmission

WILL NOT PASS STATE INSPECTION
Complaint

A failed inspection

This month's story is about a 2003 Chevy Impala that needs to have a state inspection performed to be in compliance with the state motor vehicle law. Here is a quick rundown on how my state does its test. The vehicle has to pass a safety test and an enhanced emission test. On the safety test side of the inspection, the mechanical components have to be in good working order, as well as other parts of the vehicle like the lights, tires, etc. The emission part of the test has to do with the engine and computer operating system. Since I live in upstate New York, we don't have to do a smog test or tailpipe test like the folks down by New York City. On this particular vehicle, the check engine light was not on. If that indicator light is on at the time of inspection it automatically fails.

Although the check engine light was not on, the customer's car still failed because not all of the monitors had completed. Monitors are tests that the Engjne Control Module (ECM) runs on the systems and/or components it controls. The state-run inspection program, a software program that looks at all the monitors in the vehicle's ECM, checks to see what monitors have run to completion and passed. In New York state, a vehicle older than model year 2000 can have up to two monitors not completed and still pass the emission test. A vehicle newer than model year 2000 can only have one monitor not completed.

This Impala came in with the check engine light off, but with codes P0135 and

Restoring the ground brought the oxygen sensors back online, but now they were pointing me to a problem with the cat. This EScan test verified a damaged converter.

Photos: Edwin Hazzard

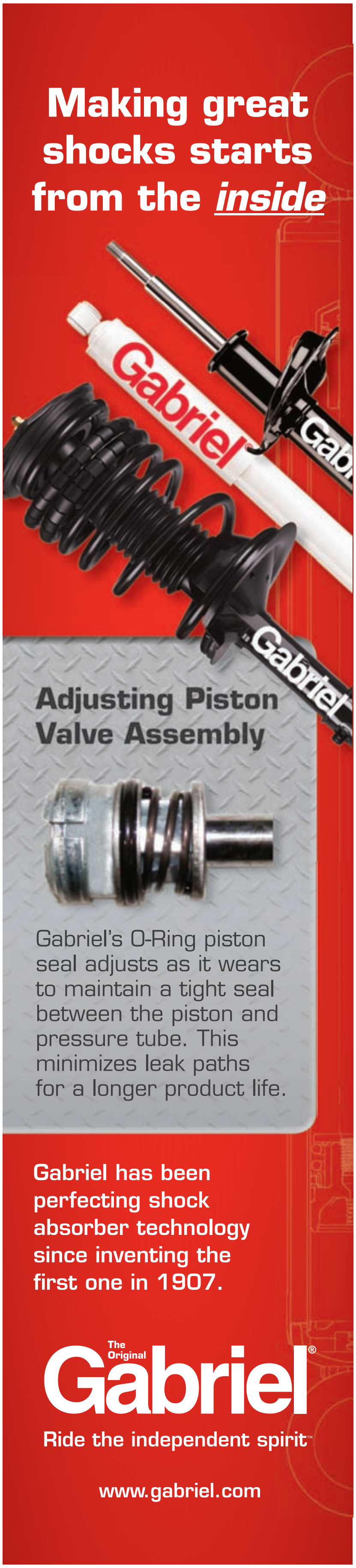
P0141 stored in the ECM memory. The description for these codes is heated oxygen sensor (O_2) performance bank 1 and bank 2, respectively. Along with the codes that were stored, the monitors for the heated oxygen sensor, the catalyst monitor and the evaporative emission monitor were not complete. Most of the time these codes are set due to the fact the O_2 sensors' internal heater isn't working correctly. The shop replaced both of the sensors twice thinking they received faulty parts. After reviewing the freeze frame data set by these codes, I didn't notice anything that stood out to alert me of a problem.

The next step was to grab a wiring diagram and look at the circuits of these two O_2 sensors. These sensors each have a four-terminal connector. Terminal A is the sensor low signal circuit, terminal B is the sensor high signal circuit, terminal C is the ground circuit and terminal D is the power feed circuit. Looking at the sensor schematic, I first checked the fuse that powers this circuit. The fuse was actually labeled oxygen fuse. I hooked up my meter to the negative battery terminal and checked both sides of the fuse. I didn't use a test light as I personally like to see the voltage being read. Remember, it doesn't take a lot of voltage to light a test light. With today's computer-controlled vehicles, using a Digital Volt Ohmmeter (DVOM) is much more accurate. So at the fuse I had 12 volts on the meter. Next I unplugged the O_2 sensor connector and put my meter on terminal D, which is the 12-volt feed from the oxygen fuse. I had a solid 12 volts. It looks like my sensors are getting the power to turn on, right?

Dynamic beats static

Not so fast. This is where you can get in trouble. Testing the voltage on an open connector is not the same as testing it with the circuit operating, and if there is a voltage drop in the circuit somewhere the only way I'll find it is to test with everything plugged in and "on". I performed a voltage drop test on the sensors' ground circuit with the connector plugged in and found that I had about 1.9 volts on this circuit. For a ground circuit that's way too much. After seeing this, I knew that our problem with this vehicle is on the ground side of the O_2 sensor circuit.

I disconnected the sensor connector and hooked up a headlight in series with the sensors' ground circuit. As I applied power to the circuit, the headlight lit up, but wasn't very bright. That tells me the circuit is still making contact, but there is a high resistance in that circuit. Looking at the circuit diagram, it shows that the ground location is G113, which is located on a mounting stud at the transmission's bell housing. I had the shop remove the stud and clean the mounting surface where the stud goes, along with the terminal ends of the ground circuit. After the work was performed, I again applied the headlight to the circuit and this time the headlight was brightly lit. One final test was to check the circuit



with my meter to check that my voltages are correct. I had 12.3 volts at my sensor on terminal D and 0.01 volts on the ground side on terminal C.

I cleared the codes out of the ECM's memory and took the vehicle on a test drive. The heated O_2 sensor monitor set rather quickly, but some of the other monitors did not. The evaporative emissions (EVAP) and catalytic converter monitors did not run to completion even after a long test drive. Based on experience, the EVAP monitor takes a long time to run its internal tests, but the converter monitor should have completed by now. I parked the vehicle and looked at the information system for Technical Service Bulletins (TSBs) on this vehicle, but did not have any luck. I went back to the car and looked at scan data. I noticed that there was a P0420 code now set in pending codes. This is one reason why it is critical to test drive and recheck every car you perform a drivability repair on. With the O_2 sensors offline, the converter monitor couldn't run. One more drive cycle and the check engine light would have come right back on.

Not quite done

The description for code P0420 is "catalytic converter efficiency low."

Intermittents are the toughest – trying to duplicate the concern long enough to get the data you need to figure out the cause.

There wasn't any heated O_2 sensor codes pending or otherwise. Now it dawned on me! With the vehicle being driven with both heated O_2 sensors not working for what I assume was a long period of time, could they have damaged this cat? With the O_2 sensors offline, this vehicle ran in open loop much longer than it was supposed to, which over a period of time is what probably damaged the cat. I had the shop replace the catalytic convertor, clear the codes and perform a road test. This time all the monitors set, and the car was able to get through the state inspection.

Sometimes when working on a vehicle, you come upon a problem that can cause another problem to be hidden. Fixing the cause could possibly show the effect. Make sure you thoroughly road test every vehicle that comes into your shop with a drivability problem. Had a good road test not been performed after the O_2 sensor repair, this vehicle would have been a comeback. Another great tool to use for a drivability problem is at Mode $06 data using your scan tool on the generic side. Looking at Mode $06 data is a great way to check and see if your repair was successful or not. Working on today's vehicles can be like going to war. Use all the weapons you have in your arsenal to win the battle.

An intermittent stall

While I was still at this shop, the owner asked me to look at another vehicle. This vehicle was a 2007 Chrysler Pacifica with a 3.8L V6. The customer complaint was an intermittent stalling problem at idle. There were no codes stored in the vehicle's EPCM. This problem would happen randomly, but only when the vehicle is at operating temperature. The question I was asking myself was

The stall occurred right at the same time the downward spike in voltage showed up on the scope.

A new ECM cured the signal dropout and the stall.

how am I going to find the problem with this vehicle when the problem only happens infrequently. With very little information to go on from the shop and the vehicle's ECM not giving me a whole lot of useful hints, I decided to look in some of my online resources — the Identifix archives — to see if this was a common problem with these vehicles. After doing a search on this, I came up empty. Since this stalling problem doesn't happen all the time and I can't find any useful information on it, should I give up or go to war? Being the stubborn tech that I am, I decided to do a little out-of-the-box thinking. I decided to hook up my scan tool and put it in record mode and see if I could tell what sensor, component or module was shutting down. I let the car run at idle for about 15 minutes while recording the scan data. Finally I was able to witness the vehicle's stalling issue. It acted like someone had just reached in and turned the ignition switch off. No stumble, rough idle or hiccup was noted. Was this car losing spark or fuel? Could it be an electrical issue? I didn't think it was losing fuel because most of the time when a vehicle runs out of fuel, it slowly dies out. But in this case it was an instantaneous shut down.

Which gun to use?

I decided to start with the vehicle's cam and crank signals as those are the two signals that report to the ECM. The ECM determines engine position from these two sensors. The ECM calculates injector sequence and engine timing from crankshaft and camshaft position. I didn't see anything on my scan tool recording and suspected that the scan tool just wasn't fast enough to catch the problem. I decided that in order to catch the culprit I needed to use a bigger gun. That gun is my lab scope. So I started off by hooking one test lead of my lab scope up to the camshaft position sensor signal wire, which is channel number 2. The other test lead, which will be channel 1, was connected to the crankshaft position sensor signal wire. I ran my ground test lead to the vehicle battery. I started the vehicle and let in run for approximately 15 minutes with the lab scope in the recording mode.

Both of the oxygen sensor grounds had excessive voltage drop and were ignored by the ECM, which suspended the monitors using the sensors for test purposes.

Finally the vehicle stalled. I saved the recorded movie and was able to view it frame by frame.

I found that channel 2 lost its signal before channel 1 did. Could the cam sensor be bad? According to the operation of this engine, if the camshaft signal is lost, the ECM can still run the engine based on the large 30-degree slot and the 30-degree tooth on the crankshaft. I had the shop remove the sensor and check the resistance. The sensor checked out fine. Next I checked the circuit from the sensor to the ECM. The wiring (the signal wire, the 5-volt reference wire and the ground wire) all checked out fine as well. I was concerned about the fact that the camshaft signal was dropping out and the car was stalling. I reattached my scope leads to the cam sensor, but this time I attached my test leads to the 5-volt reference signal and the other one to the sensor ground signal. I ran the car for another 10 minutes while recording the two circuits. Finally the vehicle stalled and I again checked the movie. This time, I noticed that the camshaft sensor ground circuit going to the ECM showed a very long spike that exceeded 2 volts. That is not good considering the cam sensor ground circuit is provided by the ECM. This ground circuit is also the ground circuit for the crankshaft sensor and other sensors. I hooked up my scope to the crankshaft sensor 5-volt reference circuit along with the ground circuit and recorded another movie. The ground circuit again showed a spike right when it stalled.

Based on the movies I recorded and the testing I had done, I suspected the ECM had an internal problem. I told the shop to get a replacement ECM, and I would come back and program it. A couple days later I returned and programmed the ECM and retested the vehicle. The car ran well and was test driven, along with letting the car idle for almost an hour. This car was fixed and the battle was won!

Both of these vehicles were tough ones to nail down. The hard part was each vehicle had an underlying problem that wasn't staring me in the face. Sometimes you have to exercise a little more patience and diligence to extract the culprit. Many techs get frustrated when chasing down hard-to-find problems. Sometimes you have to take a step back and look at the weapons you have to fight this war. Choosing the right weapon will help you win the battle and hopefully the war as well. The best weapon of choice is your brain. MA

EDWIN HAZZARD
CONTRIBUTOR

Edwin Hazzard has more than 30 years experience in the automotive industry as a tech, service consultant and mobile diagnostic tech. He is the owner of a successful mobile auto and truck repair service in Newburgh, N.Y.

Email Edwin at
ehazzard@automotivetechsystems.com

THE LOGICAL TROUBLESHOOTING PROCESS

BY **CHRIS CHESNEY** | SENIOR DIRECTOR CUSTOMER TRAINING, ADVANCE PROFESSIONAL DRIVEN BY CARQUEST

Everything you do involves a process. Every task you perform, every activity you engage in and every decision you make is the result of a process. Everything you do can be broken down into individual steps, arranged in the proper sequence and documented.

Human activities are sometimes carried out intuitively. They're some¬times carried out by trial and error; however, the most efficient way for people to carry out their activities is by following a process. There are processes for running a restaurant, processes for flying an airplane, processes for learning, and processes for problem solving. Following a logical troubleshooting process results in greatly improved productivity with much lower comeback rates.

This is a 6-Step Logical Trouble shooting Process.

1. Verify the Customer's Concern
2. Replicate the Concern
3. Analyze the Symptom
4. Diagnose the Concern
5. Perform the Repair
6. Verify the Repair

Troubleshooting is the process of investigating, determining and solving problems. Understanding and following a systematic troubleshooting process will minimize the time required to identify and correct nearly any problem. Using the logical troubleshooting approach allows you to identify and isolate almost any problem, even in the most complex systems.

Quite simply, troubleshooting is the act of problem solving; however, troubleshooting isn't only for locating problems with the customer's vehicle. Troubleshooting can be used to locate problems with anything, including interactions with the customer.

Notice that Step #3 of the process is analyze and Step #4 is diagnose? What's the difference between analysis and diagnosis?

In many ways, the verbs analyze and diagnose are seemingly synonymous. In fact, the dictionary definition for these two words reveal some similarities; however, in the context of the 6 Step Troubleshooting Process, analysis and diagnosis are two distinct and critical aspects of the overall troubleshooting process.

Let's take a look at the definition of these terms as they apply to the 6 Step Troubleshooting Process:

Analyze

1. to examine in detail in order to discover meaning, essential features, etc.
2. to break down into components or essential features: to analyze a financial structure
3. to make a mathematical, chemical, grammatical, etc., analysis of

Analysis is the act of gathering information, through research or testing, for the purpose of under¬standing system operation

Analysis is the act of gathering information, from one or more sources, for the purpose of gaining an under¬standing of the operational nature of a component or system. Analysis includes research of technical service information sources such as: MotoLOGIC© Repair & Diagnostics, Mitchell 1 ProDemand™ and Identifix Direct-Hit®, as well as performing infor¬mation gathering tests.

The result of analysis is not merely information. Analysis expands your knowledge and understanding of systems, components and operational strategies.

Diagnose

1. to determine the identity of a problem by examination
2. to ascertain the cause or nature of a problem from the symptoms
3. to classify or determine the cause of a problem on the basis of scientific examination

Diagnosis is the act of isolating the root cause of a problem based on analysis

The verb diagnose was first used in medicine "to make a diagnosis," or to identify a disease by observa¬tion of symptoms. It is used to describe the process of determining the root cause of a problem.

As well, there are certain concepts that significantly impact the success of your troubleshooting process. These three concepts are simple but critical.

1-2-3 of Troubleshooting

1. Adopt and maintain a PPTA [Positive and Productive Troubleshooting Attitude]
2. Acquire the correct knowledge
3. Follow the troubleshooting process

ADVANCE PROFESSIONAL

To learn more about troubleshooting, visit **www.CTIonline.com** offered by Advance Professional Driven by CARQUEST.

KNOWLEDGE GAP: SPARK PLUG GAPS DEMYSTIFIED

The infamous spark plug gap. It's the tiny space between the center and side electrodes. But you may have questions: Do spark plugs come "pre-gapped?" Do I need to adjust the gap? How do I know what exactly is the right gap for my application? There always seems to be some confusion on the subject, even among the most seasoned pros.

Autolite® (and all spark plug manufacturers, for that matter) offers spark plugs pre-gapped in the most popular gap sizes. But because of the many gap sizes required, no one offers spark plugs properly gapped for every single application. Gapping has always been the job of the technician. However, you can be sure that the Autolite spark plug recommended for your application has been engineered to meet the specific requirements of your engine, and that the gap can easily be adjusted as required.

Don't assume that the spark plug gap was preset at the factory when the spark plugs were made. While Autolite engineers pre-gap spark plugs for the most popular applications, the same spark plug may be designed for two different engines, and these may specify different gaps. Therefore, the spark plug gap must be set properly before the plug is installed—even with new plugs. If the gap is too wide, the electrical voltage may not be high enough to arc across, which would result in a misfire. If the gap is too narrow, the spark may not ignite a "lean" air/fuel mixture, which would also result in a misfire. To put it another way, a spark plug's voltage requirement is directly proportional to the size of the gap.

Before you install new spark plugs, adjust the gap using a spark plug gap tool or gap gauge – there are several different designs available. If you need to widen the gap, use the spark plug gap tool to pull back on the ground strap (also called the side electrode). If you need to close up the gap, gently tap the ground strap electrode on a hard surface. It's extremely important not to touch the center electrode or the insulator during this procedure, since these can be damaged easily.

Proper spark plug gapping isn't complicated, but it is critical for efficient engine performance. Autolite has more information available online, including helpful videos and FAQs to take all the guesswork out of spark plugs, and help keep your customer's vehicles properly in tune.

For more information, **visit www.Autolite.com.**

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WHAT THE BRAKE PEDAL REVEALS

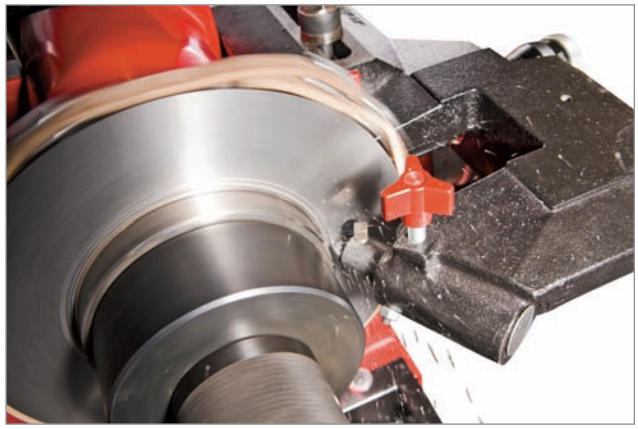
Q: The brake pedal is pulsating under your foot and the steering wheel is vibrating whenever the vehicle slows down or come to a stop. The pressure in all four tires is perfect and so is the alignment, so what could be causing the problem?

A: Steering wheel vibration during braking is typically caused by warped front brake rotors. When you step on the brake pedal inside the car, brake fluid is sent to the brake calipers. This causes hydraulic pressure to squeeze the brake rotor in between the brake pads. The brake rotor, in time due to normal wear and tear, can become "warped" or have uneven spots or wear on the surface. It can also warp because of expansion and contraction of the metal disc rotor because of driving through a puddle of cold water, or after a long trip on the freeway then applying the brakes, or due to severely worn-out brake pads that have been grinding metal to metal on the brake rotor.

Q: How does rotor warp cause pulsation in the brake pedal?

A: When the brakes are applied, the caliper and the brake pads squeeze the rotor, which causes the car to stop. The

RL-8500


Here is an example of the truing process.

brake rotor is turning the same speed as the wheel. If the rotor is warped, the brake pads will pulsate inside the caliper as they come in contact with the high spots. This vibration can sometimes be felt inside the car at the brake pedal. The vibration is usually felt when applying the brakes in a panic type situation at higher speeds, and can also be noticed when coming to a full stop, like at a stoplight.

Q: What can be done to correct the problem?

A: The brake rotor can be removed from the car and trued using a brake lathe similar to the Ranger RL8500. This combination brake lathe is designed to recondition the surface of rotors or drums by making them smooth, or "true" again (see illustration above).

The brake rotor will have a limit to how much of the material can be removed or shaved off, and this minimum thickness is usually stamped on the rotor or drum for the mechanic to see. If the rotor is below minimum thickness specifications, it will have to be replaced.

FASTER, MORE ACCURATE AND EASIER THAN ANY OTHER LATHE IN IT'S CLASS

We hear it all the time: what's your brake lathe got that the other guys don't? But maybe a better question would be, what's missing?

When we built the Ranger **RL-8500** and **RL-8500XLT** heavy-duty brake lathes we ripped out the clunky gear box, variable-speed transmission, and any sense of fear. Then we replaced all that with fierce independence—two independent DC servo motors to be exact. Now they control the cross and spindle feed drives to give you a better-than-factory smooth finish every time.

While those other brake lathes are trembling on their stands over a less-than-perfect drum, rotor, or flywheel, the **RL-8500** models have got you covered with solid nerves of steel.

And who doesn't love that kind of confidence?

SEE THE ULTIMATE NICKEL TEST

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OF STEERING RACK SERVICE TIME CUT IN HALF

Disconnecting steering rack components can be a day killer. Tight clearances and corrosion can leave you with busted knuckles and searching for any solution. Steering rack wrenches either only touch three sides of a tie rod or have a boxed end that are only useful when you can reach the top of a tie rod.

"Being able to wrap around a tie rod, sway bar or anything in the steering rack provides incredible time savings for a technician," said Dirk Skogerboe, OTC product manager. "We pored through our specialty tools and realized there was a better way, and one that can help techs save time and money."

Taking principles from steering rack wrenches, OTC engineered the locking collar rack wrench, part number 7485. Made of durable tool steel, the wrench features an eccentric cam design and split-circle, which opens to wrap around and securely close on steering components. The ½" square drive cam automatically adjusts to the diameter of the bar, locking securely. It helps technicians create maximum leverage and a secure grip to position and maneuver components during vehicle service.

When underneath a vehicle, replacing or adjusting one piece of a steering rack can require moving, loosening or removing several parts. Often a job time will be four hours or more, and the OTC 7485 locking collar rack wrench can cut that in half.

"The time-saver here is that technicians don't have to remove or disconnect pipes or rods to adjust them. The service becomes faster and easier, helping them beat flat rate," said Skogerboe.

Any shop doing a lot of undercar work, including steering and suspension service, is looking for an edge in getting a customer back in their car

faster. Having the right tools to remove and replace individual parts can mean the difference between returning the car same-day or spending frustrating hours in the bay.

Skogerboe added, "the tool splits in two, with spring-loaded ball bearing pins locking the two sides together. It'll fit nearly anywhere and because it comes apart, you can wrap securely around whatever you need."

A lobed, ridged cam with ½" square drive tightens around a pipe as the tool is turned. The positive-locking ridges allow a technician to gain and hold maximum leverage with an extension bar or socket wrench.

Being able to surround the pipe also means a component can be attacked from under the hood or under the car. Space and orientation is less of a consideration, as the tool is designed to fit in small spaces. In addition, the short, slightly angled stem on the ½" drive cam helps to provide more leverage and account for awkward and tight angles found in a vehicle's front end. The locking collar rack wrench can be used on steering linkage, small-diameter exhaust and other pipes that need to be adjusted or repositioned. The cam design adjusts from 1" to 1-7/8" in diameter to fit a number of front-end components. Additional applications include strut cartridges and wheel alignment, which allows for repositioning without disassembling or removing connectors.

OTC TOOLS

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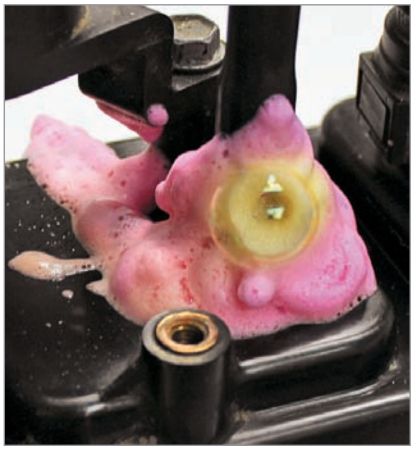
P-888-533-6127
inquiry@service-solutions.com
www.OTCTools.com

DIAGNOSING HARD TO FIND LEAKS

Finding leaks can be a very frustrating job where many labor hours can be lost. Perhaps some of the toughest automotive leaks to find are A/C and fuel vapor (EVAP) leaks. These leaks can create problems for shops when the location of the leak cannot be found causing costly comebacks. There has not been a good reliable method of leak detection until the Revolutionary Bullseye Leak Detector.

The Bullseye Leak Detector is "the most advanced leak detection system available." This Patent Pending technology allows the technician to quickly and accurately locate the leak site in all sealed systems. The revolutionary Bullseye system works by pressurizing the system with system-safe CO_2 from pressures of .5 PSI to 150PSI. The Bullseye advanced electronic CO_2 Leak Detector is used to locate the approximate area of the leak. When using any gas based electronic leak detector finding the exact location of the leak site can be difficult, especially if several connections or components are all located within a small area. Because CO_2 gas will cause our specifically-formulated foam to change color, pinpointing the source of the leak is simplified. The Bullseye Leak Seeker foam is applied to the general area identified by the CO_2 detector and any leaking CO_2 will change the color of the foam from a pinkish red color to yellow at the exact location of the leak site. The use of CO_2 gas makes false detection a thing of the past allowing you to be absolutely positive as to the location and size of the leak.



The Bullseye Leak Detector finds leaks in EVAP systems, A/C systems, Engine cooling systems, Combustion gases in cooling system, Oil leaks, Induction leaks, Tires and wheels, Air ride suspensions, Air brakes, and much more. This revolutionary tool takes the guess work out of finding leaks.

Perhaps the smallest leaks are in Air Conditioning (A/C) systems. In general a leak in an A/C system is smaller than five ten thousandth of an inch (.0005) and can be smaller than one ten thousandth of an inch (.0001). This .0001 leak sites area would be .0000000078, and that's small! These extremely small leak sizes result in very small volume losses of refrigerant which create problems when trying to locate the site of the leak. Even these minute leaks result in refrigerant loss over a long period of time that will eventually affect the performance of the air conditioning system. If a leak is identified as an issue, identifying the location of these small leaks is challenged by the limited amount of gas escaping in a short period of time. Only the very small amount of refrigerant lost during your investigation into the location of the leak site will be available for detection. The smaller molecule of CO_2 under a higher pressure allows a much higher volume of CO_2 to escape from the sealed system. This makes it easy to find leaks in all A/C systems. And if the Bullseye can find these small leaks, fuel vapor leaks (EVAP system) will be a breeze to find!

The Bullseye CO_2 Leak Detection is a revolutionary method used to quickly locate leaks. When you are serious about accurately finding leaks in sealed systems and you cannot afford the time and money for a comeback it is clear the Bullseye Leak Detection system is your answer.

AUTOMOTIVE TEST SOLUTIONS

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When Conventional Diagnostics Fail...
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FIND VERY SMALL LEAKS QUICKLY AND ACCURATELY!
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6 NEW INSTALLATION VIDEO TIPS FROM CARDONE

Check out these new videos highlighting quick tips that will help you properly diagnose vehicle issues and avoid common installation problems. Simply scan these QR codes, and the videos will automatically play!

GM Electronic Throttle Body (ETB) Relearn Procedure

Problems with poor idle after a GM Throttle Body install? We show you how to perform the PCM relearn procedure, so your vehicle runs normally.

How to Use a Pressure Gauge to Pinpoint Power Steering Issues

We show you how to eliminate the guesswork when diagnosing power steering issues by using a pressure gauge.

How to Correctly Fill ad Bleed the Power Steering System

Are you replacing a power steering system component? This video shows you the proper way to fill and bleed the system for optimal performance.

1997-2002 Ford, Lincoln, Mercury SUV Rear Wiper Motor Installation Tips

The tips in this video will help you install CARDONE rear wiper motor Part# 40-2023, which fits various Ford, Lincoln and Mercury SUV's including Explorer, Expedition, Mountaineer and Navigator.

1996-2000 Dodge, Plymouth Minivan Power Brake Booster Installation Tips

Check out this video for some simple tips to eliminate damage to the Power Brake Booster during installation on 1996-2000 Dodge/Plymouth minivans.

Chrysler PCM VIN Programming Tips

Installing a Powertrain Control Module (PCM) on a Chrysler vehicle? Check out this quick video offering a few tips to ensure a successful install with no error codes.

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ONE STOP FOR BRAKES: MAGNETI MARELLI OFFERED BY MOPAR BRAKE KITS COVER KEY HARDWARE

In the service industry old habits can die-hard. Sometimes it's industry changes that render practices obsolete. With today's customers increasingly sensitive to comebacks and performance issues, the trends towards all-inclusive service kits continues to grow. And in many cases, dollar-for-dollar differences in fully inclusive service kits compared to bare-bones parts kits have narrowed substantially due to economies of scale.

One area in particular where all-inclusive kits vs. pad-only SKUs is growing fast is in replacement brakes. Due to the complexity of modern brake designs and increasing demand for precision, wear and tear on springs, clips, shims and other hardware breakdowns, resulting in a long list of potential comeback issues. Take your pick: rattles, overheating, excessive brake dust, uneven pad wear, squeals and the list goes on.

The approach from Magneti Marelli Offered by Mopar® is to package brake components in all-inclusive kits to ensure your repairs are precise, reliable, and most of all, safe. Adding to their inclusivity is the number of brands their brake kits cover. Available in North America and distributed by Mopar®, Magneti Marelli brings high quality automotive parts to all makes in the aftermarket. This goes beyond popular Chrysler, Dodge, Jeep® and FIAT® brands, to include a full line of brake kits for Ford, Chevrolet, Toyota, Honda, VW, Hyundai and more.

On the brake performance end, Magneti Marelli brake pads are lab tested to perform under all types of driving conditions from summer hot and dry, to wet, winter weather. One test in particular is the SAE J2521 noise frequency test. It demonstrates Magneti Marelli's compounds shifting brake noise to frequencies lower than the human ear can recognize for quieter operation.

Key Product Notes

- Exclusive friction formula to prevent noise or black dust
- Premium ceramic or semi-metallic brake pads that eliminate squeal
- All-inclusive hardware packages comprised of high-quality stainless steel in every kit
- 100% factory-installed shims to deliver quiet braking without messy anti-squeal sprays
- High-temp moly-lube which lasts the entire brake life
- Manufactured in North America

Beyond the technical specs, Magneti Marelli is confident in their products, enough so to offer a lifetime limited warranty on brake pad kits and shoes with a $150 labor reimbursement for 24 months and unlimited miles.

Next time you're ordering brake kits, take a look at Magneti Marelli's all-inclusive kits. They're definitely looking to make a lasting impression on the aftermarket and change the way shops look at brake kits.

For more information, **visit www.magnetimarelli.com.**

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Offered by:
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Quality Auto Parts for All Major Makes

MOTORCRAFT® A/C COMPRESSORS: THE KEY DETAIL IS PROPER FLUSHING

When contamination or failure causes compressor issues, a proper flushing procedure is needed to keep a new or reman compressor from seizing up.

Fact is, it takes very little foreign matter to restrict flow of refrigerant and oil in a vehicle's A/C system. Whatever is circulated – including dirt, metal, debris or contamination – will affect every component: condenser, hoses, tubes, evaporator, drier and accumulator.

If the A/C system is equipped with an orifice tube, you'll want to remove it and inspect closely. If you find foreign matter, you'll probably need to flush the system. Checking the rest of the components will confirm if the procedure is necessary.

To flush properly, start by removing and recovering all refrigerant. Be sure to store or dispose of the substance according to requirements and standards. Next, dismantle the A/C system and remove the components that will be flushed starting with the refrigerant lines from the heat exchanger(s). Flush the A/C hose from the compressor to the condenser. Flush each heat exchanger and hose assembly separately for a minimum of 15 minutes.

Force flushing agent with pressurized air for a minimum of 30 minutes through each component to purge and evaporate all residual solvent. Failure to remove all residual solvent within the component can result in system damage when reconnected and operated. Dispose of the used flush solvent and filter in accordance with local, state and federal regulations.

If equipped, you'll need to install:

- A new A/C evaporator core orifice
- A new suction accumulator
- A receiver/drier or receiver/drier cartridge
- New refrigerant hoses with mufflers

Reconnect the heat exchanger and reassemble the components and any replacement parts. Use new O-rings and gaskets for every connection you've taken apart. Don't use PAG or ESTER oils on O-rings as these lubricants attract moisture, which can cause rust or corrosion on a joint. Replacement driers or accumulators should be installed last just before the vacuum.

Before resealing, purge the entire system with nitrogen. This will help eliminate any moisture that may be left in the system after flushing. A deep vacuum should be pulled for at least one hour on any system that has been flushed. When you flush the evaporator, vacuum for at least two hours.

Perform a leak test on all joints that have been dismantled. You can use either an electronic leak detector or external leak test fluids that are designed to show the smallest bubble at the point of the leak. Once complete, set the refrigerant charge amount and start the charge of refrigerant. Always refer to specifications for proper quantities. Lubricate the refrigerant system with the correct amount of clean PAG oil.

After finishing, be sure to "hand turn" the compressor clutch at least 10 times before restarting the A/C system. This will ensure that any liquid (refrigerant and oil) is slowly removed from the compressor, avoiding a hydraulic lock upon start up. Check the pressure gauge readings after your start up.

When working on Ford or Lincoln vehicles take a close look at Motorcraft compressors. They're built to OEM standards and meet stringent specifications for a precise fit. Each one is made for a specific vehicle, whether a new or replacement compressor — all clear advantages.

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www.motorcraft.com

HOW TO SERVICE THE NEW CONTINENTAL TPMS SENSOR

Now that many vehicles are TPMS-equipped, you need to take care that the TPMS sensor and valve are not damaged during tire service in order to maintain this valuable safety system for your customer. Knowing the variety of TPMS sensor types and their service requirements will help streamline the job and optimize shop productivity. Here are valuable tips on properly servicing the Continental rubber snap-in valve TPMS sensor:

Proper installation:

Step 1: Always use a new rubber stem. Make sure the sensor and valve stem are not attached, as this may damage the sensor.

Step 2: Insert the valve stem into the rim hole and make sure that the notches in the stainless steel roll pin are facing down toward the wheel. This way, the sensor can be properly clipped in place after the valve stem installation. (Fig. 1)

Installing valve stem

Step 3: Pull the valve stem into the rim hole, keeping it in-line with the axis of the rim hole until the valve bulb is fully seated against the rim for an air-tight seal.

Step 4: Attach the sensor to the valve stem by pressing it in place with the built-in clip. Make sure that the sensor is parallel to the rim. The translucent white cover of the sensor must face down toward the wheel. (Fig. 2)

Attaching sensor to valve stem

Proper removal:

Step 1: Dismount the tire and press the sensor clip to remove the sensor housing from the stem. (Fig. 3)

Detaching sensor from valve stem

Step 2: Attach the valve stem puller to the valve.

- TIP: For easier valve removal, make a circular cut around the valve bulb on the inner side of the rim.

Step 3: Pull the stem straight out while keeping it in-line with the axis of the rim hole.

- TIP: To prevent damage to the rim hole, make sure the notches in the roll pin are facing away from the wheel. (Fig. 4)

Roll pin alignment

The importance of following procedures

According to Steve Landis, Continental's Head of Product Management, TPMS & Electronics Innovation – NAFTA, "A little extra attention really pays off whenever installing or removing a Continental rubber snap-in valve TPMS sensor. Unlike other sensors, this unique Continental design does not require extra attachment hardware or torque settings. Check out our brief step-by-step instructional videos at http://tg1d.vdo.com, and make your next TPMS service a snap!"

Since the 19th century, Continental is a committed partner for automotive. Continental's in-house development and manufacturing expertise includes complete TPM Systems, replacement parts (including the aftermarket REDI-Sensor) and passenger / commercial vehicle tires. All TPMS replacement parts are made in ISO-certified facilities to the same OE parts quality standards.

CONTINENTAL

http://tg1d.vdo.com

Continental

www.redi-sensor.com

TPMS service with VDO REDI-Sensor™ was always a snap. Now it's also available with a rubber snap-in valve stem!

The VDO REDI-Sensor multi-application TPMS sensor has already made TPMS service faster and easier by eliminating the need for programming and cloning. Now, for service techs looking for the option, we're also offering REDI-Sensor with a familiar rubber snap-in valve stem. And just like the original REDI-Sensor, our new rubber valve stem version is ready right out of the box!

- Pre-programmed and designed to follow OE vehicle relearn procedures
- Works with all major TPMS scan tools
- Reduces inventory and eliminates service delays
- OE designed and validated

Visit: www.redi-sensor.com for more information.

REDI-Sensor™

VDO

FUEL SYSTEM DIAGNOSTICS

A malfunctioning fuel system can prevent an engine from starting but so can other problems such as lack of spark, a blocked air intake, or a broken timing belt and simply no fuel in the fuel tank. Be sure to rule out these possibilities before continuing to diagnose the fuel system.

Inspect: Visually inspect the fuel system components for bent or kinked hoses and pipes, damaged electrical connectors, and a dented or collapsed fuel tank that may be preventing the fuel pump module from operating properly.

One of the easiest ways to determine if the lack of fuel may be the cause of a non-starting engine is to spray some aerosol carburetor cleaner directly into the throttle while the engine is being cranked. If the engine starts, runs a few seconds and dies, it has spark and compression but is not getting any fuel.

Lack of Fuel: Fuel delivery testing will ensure that the proper fuel pressure and volume are available under all possible operating conditions. Testing can be categorized into two areas:

- No-start diagnostics
- Performance-related diagnostics

In addition to testing for pressure and volume, measuring the amperage of the fuel pump circuit can help determine the cause of a malfunction.

Listen: Often the first step in diagnosing a faulty fuel system is to simply listen. Turn the ignition key to the run position and carefully listen for a slight humming sound coming from the fuel tank. This humming sound should immediately follow turning the key to the run position and continue for approximately 2 seconds before stopping. When this humming sound is heard, it can usually be assumed that the fuel pump electrical circuit is functioning and that the fuel pump is running, which means that the next diagnostic steps should include determining if there is an adequate amount of fuel in the fuel tank and then testing for fuel pressure and volume. If the humming sound was not heard, then the next diagnostic steps should include verifying the lack of any fuel pressure with a fuel gauge or scan tool and then checking the fuel pump electrical circuit.

The Delphi Difference

- Fuel systems expertise
- Patented, innovative OE technology: 30 OE-proprietary innovations and 150 patents
- OE tested for reliability up to 150,000 miles. Some tests will run over 10,000 hours continuously – that's over one year non-stop.
- Durability tested to withstand up to 22 percent ethanol.
- Tested in corrosive, contaminated E22 fuel blends for long life and fewer comebacks.
- Designed to withstand extreme temperatures ranging from -32˚C to 65˚ C.
- Streamlined part numbers to reduce inventory.

Win the Delphi Dream Shop

Delphi will give $10,000 to one lucky U.S. or Canadian technician to use toward filling their own Dream Shop. Upgrade an existing workspace with tools and equipment or buy a favorite classic car for their garage.

Technicians can register at the dedicated Delphi Dream Shop website (delphidreamshop.com). They can also access it through delphiautoparts.com or through Delphi's Facebook page (facebook.com/DelphiAutoParts). In December, three finalists will be announced and then flown, with a guest, to Detroit for the North American International Auto Show in January 2016 when the grand prize winner will be selected.

In addition to the grand prize, registrants are eligible to win monthly, weekly and instant prizes. Visit the website to enter. Each visit is worth another entry into the prize drawings and each day is another chance to win prizes.

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MAKE SURE YOUR CAT IS HOUSEBROKEN!

Just like a new engine or a pair of leather shoes, a replacement catalytic converter needs a proper "break-in" period. This will ensure that the cat will continue to work the way it was designed and deliver the required emissions reliability and long service life. If the converter is not warmed-up (broken-in) properly, the substrate inside could be adversely affected and eventually cause the converter to fail down the road.

The problem typically occurs when a shop installs the converter and immediately returns the vehicle to the customer. The customer drives away under heavy acceleration or drives with frequent start/stops for an extended period of time. Under these conditions, the matting, which is designed to hold the substrate in place, will not expand properly and could fail in doing its job.

Converter matting is made from a mineral called vermiculite, which is held together by a fiber mat and an organic binder. This matting is wrapped around the converter's ceramic brick (See Figure 1). The matting is installed in the converter in an unexpanded state (See Figure 2). During the first heat up, the fiber mat and binder burn off and the matting actually gets looser before it expands to fill the converter cavity to hold the ceramic brick in place (See Figure 3). If that warm up is not done properly, the brick can come loose and get damaged. That rattle you might hear inside the converter shell is a sure telltale for this problem.

Warm up the cat first

The best way to avoid this service issue and potential warranty problems is to make sure that the warm-up period is a key part of your overall converter installation procedure. This heating cycle will allow for correct matting expansion.

Here are suggested steps for a proper break-in or warm-up:

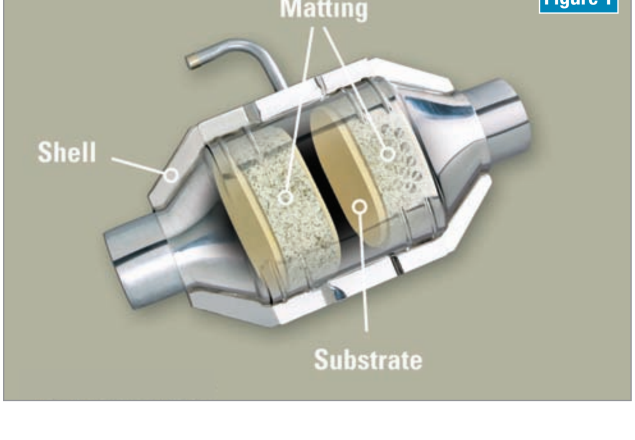

Figure 1

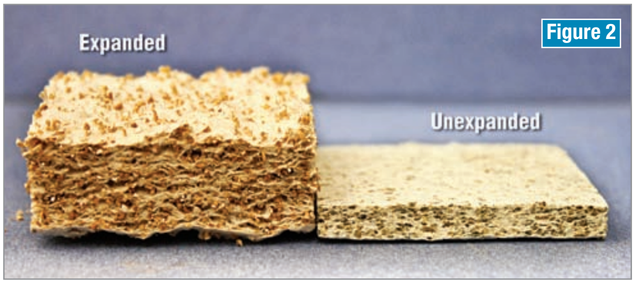

Figure 2

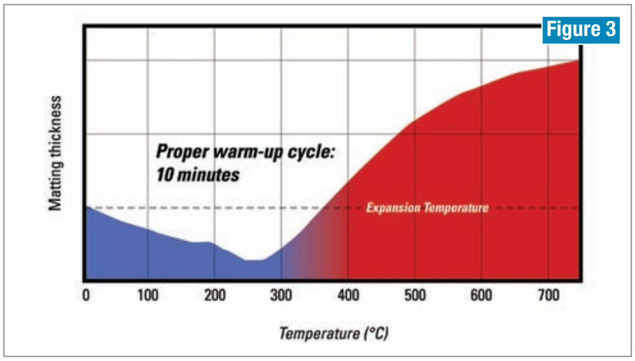

Figure 3

1. Start the vehicle but do not rev the engine.
2. Idle the vehicle and allow it to warm up slowly.
3. After 5 minutes, increase the engine speed to 2500 RPM.
4. Hold at 2500 RPM for 2 minutes.
5. Allow vehicle to cool down.
6. Road test to confirm correct installation.

Courtesy of Eastern Catalytic, a leading innovator and world-class manufacturer of catalytic converters, offering a full range of universal, direct-fit, manifold, diesel, and heavy-duty catalytic converters.

WHEN SHORTCUTS ARE NOT A GOOD IDEA

Shortcuts are often great. They can save us time, they can save us distance and they can save us extra work. As technicians, we need to utilize short cuts every day. It may be that new tool that allowed you to complete the job 20 minutes quicker, or a new technique to execute a repair that a new tech brought with him from his old shop.

Remember that first time when you saw someone unbolt the pick-up truck box so he could raise it up in order to get to the fuel pump located on top of the fuel tank? I remember the first time I saw that. I also remember the other technicians standing around in a group laughing and making jokes about this unorthodox way of replacing a fuel pump. The rest were all old school on this. Raise the vehicle up, unbolt the straps (hopefully not rusty and they don't break), raise the jack up under the tank, bring the tank down and hope and pray that the tank is not full of gas and that you disconnected every fuel line. That is the way it has been done for years. If it ain't broke, don't fix it, right? We have heard that expression for years.

Now here comes that new kid with a new idea. Well it only took a number of days before the rest of the technicians were now replacing fuel pumps by unbolting the pick-up box and raising up one side. Now it was nothing to laugh at. Everyone was doing it. No more getting a shower of gasoline, no more broken fuel lines or clips, and you got the job done much faster. So shortcuts are a good thing right?

In many cases they are, but not when it comes to the parts you use. OEM, engineered to OEM specifications, OE form, fit and function. Meet or exceed OEM standards. Sounds great, right? So what exactly does all of this mean? What it means is that the manufacturer of these parts has gone through the pain-staking process to engineer and build all of the components of the part so that they are as good or better than the original.

No one likes installing a new hub or bearing assembly only to find out that it does not fit properly. Or that you have to splice in a new connector. Or that you have to take the sensor off of the old part to install on the new one, only to find out after all of this extra work that this new part does not work properly. That was a part's shortcut. You do not gain anything this way, and in fact, you lost valuable time that you could have been repairing another vehicle and satisfying a customer. So, make sure to use a part engineered to exceed the manufacturer's specifications and you will not be faced with these types of problems.

That is what has been done with FVP Hubs and Bearings. As well as all of the other products offered by FVP, which are distributed by Factory Motor Parts. FVP parts are engineered to provide OE quality that is equal or superior to the national brands. So when it comes to parts, is it worth cutting corners or taking a shortcut? Our advice would be no.

FVP now offers batteries, radiators, condensers, filters, antifreeze, motor oils, diesel exhaust fluid and automotive chemicals.

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CLEAN & DRY: FACTS ON APPLYING SEALANTS TO GASKETS

One of the most commonly asked and searched questions in the "Break Room" technical forum at www.felpro-only.com is, "Do I need to apply sealants to your gaskets?"

In the past, it was common to coat a gasket with sealers, adhesives or RTV before installation. The rule of thumb today for modern, high-quality gaskets is "Install Clean & Dry." With sophisticated materials and coatings, Fel-Pro® gaskets are designed specifically for the repair environment so they can seal less-than-ideal surfaces. Applying RTV or other sealers to the gasket surface could reduce its ability to form a reliable seal.

When should you "Install Clean & Dry?" Here are a few pointers:

Oil Pan Gaskets

High-quality **molded-rubber** gaskets such as Fel-Pro PermaDryPlus® do not require a chemical sealant on the gasket. Do, however, apply RTV to the block casting at the 90-degree joints at each end of the end-hoop seals.

Press-in-place molded-rubber gaskets such as Fel-Pro PermaDry® do not need a chemical sealant. Some engines will need a dab of RTV at the joints where the timing cover and/or rear main seal carrier meets the block.

For **cork-rubber** gaskets, there's no need to apply sealant to the side rails. Add a small amount of RTV to the block casting at the 90-degree joints described above.

Head Gaskets

Fel-Pro applies proprietary rubber coatings formulated for the repair environment that allow head gaskets to seal better. With the exception of early-generation copper or steel-shim gaskets, do not apply sealant to the head or block surfaces or gaskets themselves.

On older, **copper and steel** gaskets, it's sometimes appropriate to apply a spray-tack sealant, but only if the gasket surface has not already been coated with a silicone top sealer.

Intake Manifold Gaskets

As their name suggests, Fel-Pro **PermaDryPlus** intake manifold gaskets should be installed "Clean & Dry." Their advanced materials and designs address specific sealing issues associated with each corresponding engine. RTV should be applied only to the castings at the joints where the side rails and end seals meet.

When installing gaskets featuring a **plastic carrier with molded silicone beads**, do apply a small amount of RTV on the casting at the end of the gasket where the side rail meets the end seal.

For **composite** gaskets, apply a small amount of RTV to the casting surfaces where the end seal meets the head and block. No other sealant should be used.

If you're installing an old style, **stamped-steel valley pan** gasket, you need to use a sealant on the gasket's non-conformable surface. Add RTV at the point where the end seal meets the block and head. Also apply RTV to the stamped beads around the coolant ports on both sides. Then apply a brush-tack sealer around each of the intake ports on both sides.

For **paper** gaskets, no sealer is necessary.

Valve Cover Gaskets

In most cases, "Install Clean & Dry," both for **cork-rubber** and **molded-rubber** gaskets. The exceptions are applications where the intake manifold meets both the head and valve cover. In these cases, there might be a "step" or joint that requires a dab of RTV.

Follow our 'Fit Forms'

Fel-Pro gaskets come with detailed "Fit Forms" covering surface prep and gasket installation requirements. Follow these instructions for the 100-percent leak-proof seal you've come to expect from Fel-Pro, "The Gaskets Professionals Trust™."

For more information, **visit www.felpro-only.com.**

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LET FEDERATED AND KYB HELP YOU BECOME THE ESC EXPERT

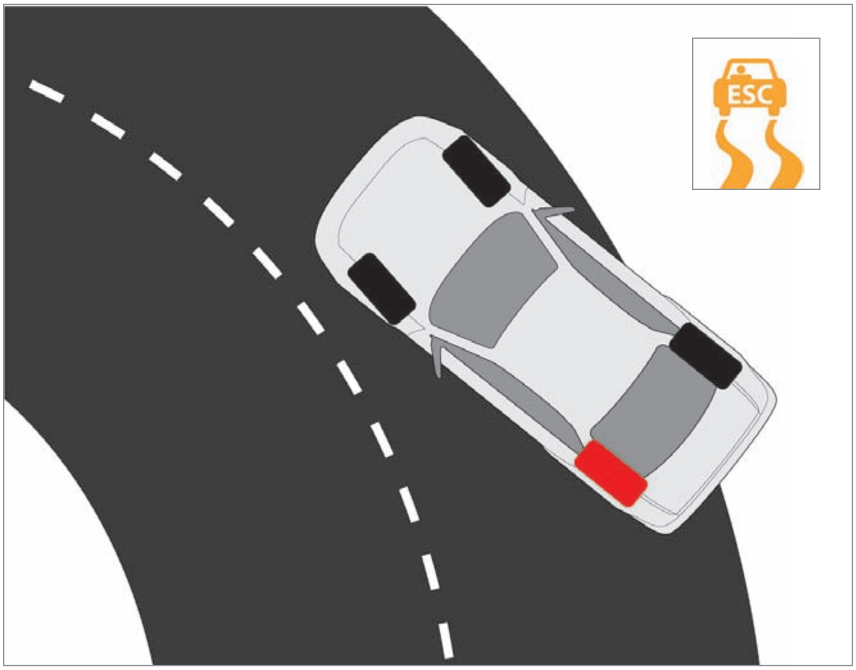
Do you know what ESC is? If it has not already been part of work load, maintaining and repairing ESC systems is going to become an important part of your service work. Being knowledgeable and prepared to service ESC systems is not only going to make you a hero to your customers, it is also going to allow you to take advantage of a great business opportunity.

ESC, or Electronic Stability Control, is vehicle technology designed to reduce accidents and save lives. It is a high-tech on-board electronic system that helps prevent spin-outs and roll-overs. ESC is now required on all new cars, light trucks and SUVs.

Most accidents that involve losing control of the vehicle occur when the vehicle is driven beyond its traction limits, such as over-steer or under-steer conditions, or driving too fast for road conditions. ESC senses the conditions that could cause a roll-over and then takes the appropriate action to prevent it from happening. It instantly reduces engine speed and applies one of the individual wheel brakes in just the right amount to keep the vehicle in control.

If a vehicle in your shop is model year 2000 or newer, it may have ESC. In fact, the U.S. government has mandated that all 2012 vehicles must have ESC safety systems. Some of the vehicles you service may have an ESC system and you may not even know it since ESC is sometimes called by different names depending on the manufacturer.

A vehicle's ESC system has an array of sensors providing vehicle operation conditions to one of the vehicle's on-board computers. When the computer determines that the vehicle is losing control, it instantly begins reducing engine speed through the engine management system and then applies the appropriate individual brake in just the right proportions to keep the vehicle in control.



There are two big reasons to know whether the vehicle has ESC or not. One is that the effectiveness of ESC is limited by the ability of the tires and the vehicle's suspension. If the tires can't grip the road, then it's just like driving on ice and will cause the ESC system to engage when it is not needed. Therefore, it is important to have good tires and ride control components that aren't worn.

The second important reason is that replacement parts (like shocks and struts) must be calibrated to perform within the vehicle's design. Some aftermarket parts (especially low cost/low quality parts) are not as compatible. These parts will affect the performance of ESC and may cause brakes to apply when vehicle owners don't want them to be applied.

Federated and KYB are working together to give you an ESC program that will provide you the training and high-quality KYB parts that will make you an ESC expert. For more information, contact your Federated Auto Parts distributor.

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† FRAM Group testing of average filter efficiency of FPS8A, 3387A, and 4967 or equivalent FRAM Pro Synthetic® models under ISO 4548-12 for particles greater than 20 microns

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DIAGNOSE MULTIPLE DTCS FASTER

Diagnosing complex vehicle issues is a common challenge these days for service professionals. One issue you probably encounter frequently is the vehicle that arrives with the check engine light on and several different DTCs present when you test it with your scan tool. What is your strategy in that situation?

There's no doubt that with different vehicle systems being connected in new ways, diagnostics is getting more complicated. When you encounter multiple DTCs, how can you quickly determine which one to diagnose to get to the root cause of the problem? With so many components and systems on newer vehicles, you clearly need to avoid replacing every part the DTCs suggest might be faulty.

You probably turn to your repair information software to research the DTCs and see if a logical solution pops out at you. Drilling down to the correct component is often a process of elimination. Many technicians take the opposite approach and clear all the codes, drive the car to see which code comes back, and then diagnose that. This can be risky, as an intermittent problem may exist, or specific vehicle operating conditions may need to be met to expose the problem that caused the other codes to set.

Mitchell 1's ProDemand repair information product has recently introduced ProView, a new feature that helps with this type of scenario. It's another way of looking at DTC information that shows all the combinations of components that have ever been associated with the code (or codes) in our system. This allows you to quickly see the most commonly repaired components and plan a diagnostic strategy to resolve the problem.

To demonstrate the benefit, let's walk through a real-world example. Imagine that a 2001 Chevy Tahoe pulls into your bay with the check engine lamp on and a couple DTCs – a P0442 (EVAP system issue) and a P0155 (HO2S voltage issue). You've cleared the codes and the P0442 has come back.

Starting with that code, ProView tells you that possibilities include the EVAP canister, fuel pump, EVAP purge solenoid valve, etc., but the most common culprit is the gas cap. However, the picture changes when you add the P0155 to the mix. You see that historically when those two codes are present together, the oxygen sensor is at fault (see figure). This would probably not have been the first thing you looked at when starting your diagnostic process.

The intent is not to imply that this is always going to be the definitive diagnosis. The oxygen sensor might not end up being the problem for this particular vehicle, but having this insight guides you in a direction that you can then validate with a guided component test.

SureTrack, the diagnostic module in ProDemand, is powered by millions of "Real Fixes" based on actual experiences and repair orders from professional technicians. SureTrack offers helpful tools like the guided component tests mentioned above, along with a library of more than 750,000 waveform and parameter identification (PID) graphs to help you troubleshoot a code or symptom with a diagnostic scan tool.

Other features in ProDemand that help save time on diagnostics include advanced 1Search™ technology that delivers verified real-world fixes together with OEM data, and a Top 10 Repairs List that displays detailed information about the most common component failures, DTCs, symptoms and lookups for the vehicle you've selected.

Whether you're facing multiple codes or a "mystery" symptom, it's good to know you can rely on your repair information to guide you in the right direction to an accurate diagnosis and successful completed repair.

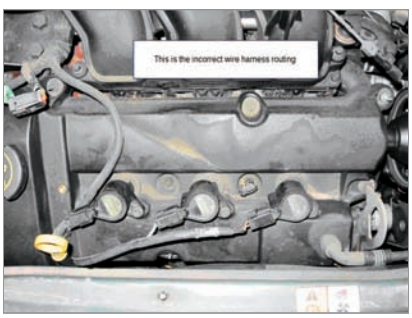
FORD ESCAPE COIL

Recently a friend of mine who owns a local shop called me about a problem concerning a 2003 Ford Escape with the 3.0L V6 engine.

The car had been dropped off with the complaint of low power, running rough and poor fuel economy. The customer first stated that one of his "knowledgeable" friends had spent a sizeable chunk of money on a tune-up and other parts that did not correct the condition, and then he asked if the shop owner would diagnose and repair the vehicle. The customer also said that his vehicle had run this way for more than a year and now it was simply not driveable.

The first step was to get the vehicle inside the shop and warmed up. Getting it started was a challenge in itself. When it did start, there was constant popping out of the throttle body. Fuel pressure was checked and showed to be good at 50 psi. Fuel quality was checked and was good. Spark was crisp and would easily jump a three-fourth inch gap.

This is how the wire harness looks in its factory location and correctly installed.



This is how the wire harness looks when installed incorrectly.

Next the scanner was installed and a code P0304 was retrieved in memory. With the misfire code present and popping in the intake, a compression test was performed on the front bank which includes cylinder 4. The compression on cylinders 5 and 6 was good at about 165 psi each, but cylinder 4 was down at 45 psi. The rear bank was checked next and showed to be OK. After talking to the customer, the shop removed the front head. Now the burnt intake valve was obvious so it was sent to the local machine shop for a valve job. When the head was returned it was re-installed using the special tools to set the cam timing and the engine was fired up. The vehicle ran terrible; power was non-existent. All previous checks were re-done with the same results with these exceptions: compression on the whole bank was now 180 psi and code P0304 set again but now also included code P0306.

When checked, there was no cranking vacuum. The exhaust was dropped and the converters were found to be plugged. I know it is hard to believe, after driving the car this way for only a year. With the customer's approval, new converters were ordered and, once installed, some ease of starting and power were restored. But cylinders 4 and 6 misfires were still present.

This is about the time I came into the picture. When the shop owner called looking for advice, I asked if we could start from scratch. I had him check spark quality again and swap the #4 and #6 coil-on-plug (COP) units to different cylinders. Next he switched the injectors from those cylinders to different ones to see if the miss would follow the injectors. Nothing worked. I asked him to disable the injectors electrically to confirm those were indeed the cylinders missing—they were. Next I had him do a running compression check, just in case the machine shop had made a mistake or had possibly gotten the cam timing off during assembly. It checked out fine. The shop owner was now panicking.

Every time this vehicle was run, the Bank 2 catalytic converter would turn bright red. He was worried that soon it would melt down and he would need to replace it again. At this point, I recommended that (if the car owner agreed) they tow the vehicle to Identifix so I could look at it during some of my free time.

First I hooked up the IDS scanner. Retrieving codes showed P0304 and P0306. Running a cylinder balance test again confirmed that these were the weak cylinders. The IDS has a nice feature called a relative compression test which identifies weak cylinders by comparing the load placed by each cylinder during the compression stroke while cranking and displaying it in a graph format. All six cylinders showed almost identical readings. With cranking vacuum better than three inches, mechanical efficiency had to be good. This left only one possibility — either spark or fuel timing was incorrect. Consulting a wiring diagram for the ignition, the Powertrain Control Module COP driver wire colors were identified. All COP units share a common power wire, White/Violet.

Each driver wire has a different colored wire for spark control. The color for driver wire 4 is

White/Pink from PCM pin 1 and driver wire 6 is Light Green/Yellow from pin 53.

Wouldn't you know it, the harnesses were swapped! Looking at the way the harness is placed, it is a natural fit to connect to the COP units backwards. To be installed correctly, the harness for the front coils actually needs to be turned over awkwardly and secured by a clip between cylinders 5 and 6. Once this was done, the vehicle ran fine.

If you have any questions, please give us a call.

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DIAGNOSTICS BOOST TECHNICIAN, SHOP EFFICIENCY

In the modern shop environment, diagnostics are a way of life. Solutions for today's constantly evolving world of diagnostic tools and equipment have proven to be a worthy expenditure for both shops and technicians. These products help techs work more efficiently with far less misdiagnoses when utilized properly. While prevalent in the automotive and heavy duty world for vehicles, they are relatively unknown for towing and trailer diagnostics. They can prove to be a great value for all shops working on any trailer ranging from small boat trailers to 53 ft. semis.

Although trailers appear to be far simpler than vehicles in terms of wiring and components, they can be harder to troubleshoot due to a lack of integrated OBD feedback and require a full functional test. Because trailers have a greater degree of exposed wiring harness and often sit dormant for long periods of time, you are often left with frequent failures and extensive troubleshooting times. The combination of these variables along with the underlying safety issue of trailers carrying heavy loads has resulted in an increase of inspections and possible citations from the federal government.

Assessing the health of the wiring harness comes with its own set of diagnostic challenges. To inspect trailer functions, the customer's tow vehicle is often used. This not only requires a second tech but also the customer to leave their vehicle. Also, any malfunction found may be present in either the vehicle, trailer, or plug/socket interface. Another method incorporated by many shops is building crude makeshift testers, which provide basic on/off functionality. However, by implementing the right diagnostic tool and equipment solutions, this process is greatly simplified, the guesswork is removed, and trailer work becomes a one-tech operation.

IPA, based in Woodstock, NY, has been the leader in professional, diagnostic truck and trailer solutions for over a decade, and offers a full line of cost-effective products to help techs perform more thorough inspections, saving time and money. IPA addresses the three possible breakdowns in towing electrical problems with a line of vehicle-side socket testers and pin cleaners for most common North American configurations. However, the cornerstone of their line is the MUTT (Mobile Universal Trailer Tester) series of diagnostic, self-powered trailer testers.

The MUTTs take all the guesswork out of trailer inspections and provide a true, one-man process with most units working via wireless remote. A technician can easily power each individual circuit and visually inspect the component for proper function. The microprocessor-controlled diagnostic brain alerts the technician to the presence of any electrical fault on the trailer harness such as short circuits, cross-wired circuits, open circuits or the very common, poor ground. By instantly being notified to the problem at hand, the diagnostic time is mere seconds and the technician can go straight to repairing the issue. Additionally, the MUTT series also allows technicians to actuate both electric and air brakes (depending on the model) to make sure all installed components are receiving power and engaging properly.

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THE IMPORTANCE OF FUEL SYSTEM MAINTENANCE FLUIDS

More than likely, you've had discussions with your customers about fuel system maintenance and fuel additives in particular. You've probably been asked whether they're really needed and how effective they are. The short answer is: it depends on what's in them.

Even high-quality fuel creates carbon deposits during combustion. Over time, those deposits can build up on engine parts, affecting performance and fuel economy. To restore performance, the deposits must be removed.

While every fuel additive uses a different formula of cleaning agents to accomplish this, the detergents most commonly used by top selling brands are polyisobutene (PIB), polyisobutylene amine (PIBA) and polyetheramine (PEA). Products using other compounds offer little to no cleaning ability.

PIB is typically used in gas treatments and fuel injector/carb cleaners. In high-enough doses, it can prevent new carbon deposits from forming, but it isn't powerful enough to remove existing deposits and needs to be used with every fill-up.

PIBA is typically used in fuel injector cleaners. Unlike PIB, it can remove some existing deposits and has a longer interval between applications. But it's not hardy enough to survive in the combustion chamber.

With temperatures as high as 495 degrees, the combustion chamber is extremely difficult to clean. Only PEA remains stable enough in high heat to remove carbon deposits in this environment. Other detergents simply burn up without effectively cleaning piston tops, cylinder heads or direct injectors. That's why any truly effective fuel system cleaner should contain PEA.

Gumout Multi-System Tune-Up® uniquely treats the entire fuel system with a scientifically formulated blend of premium cleaning agents, including PEA. But cleaning is only part of the story. Multi-System Tune-Up also includes a wide range of conditioning agents.

Antioxidants help stabilize fuel and oil in engines that are used less often, keeping varnish from developing on metal parts. And corrosion inhibitors prevent key engine parts from degrading, helping extend engine life.

Multi-System Tune-Up can be used in gas, ethanol and diesel, or poured directly into the crankcase to clean and stabilize oil. It's built to handle the requirements of modern engine technology, like GDI (gasoline direct injection), turbos and superchargers, and it's equally effective on engines without those systems, thanks to its advanced ingredients.

Like all Gumout products, Multi-System Tune-Up is thoroughly tested in our labs, in independent labs and in fleet tests. To provide statistical proof of its effectiveness, all of the relevant ASTM tests are performed.

Learn more about the science behind Gumout products and why quality ingredients really do matter at **www.gumout.com/science.**

GUMOUT

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GUMOUT®
PERFORMANCE ADDITIVES

ADVERTISEMENT

SECTION 3C

THE FUEL THAT GIVES YOUR ENGINE LIFE IS ALSO RESPONSIBLE FOR SLOWLY KILLING IT.

Fig. 1–Valves

Cleaning and conditioning the entire fuel system allows Gumout to restore lost performance and improve fuel economy.

Even high-quality fuel can eat away at performance and engine life. This happens in two ways:

carbon deposits left behind after combustion and corrosion caused by ethanol.

Over time, carbon deposits build up on key engine parts. Gumout® bonds to those deposits and removes them to restore performance.

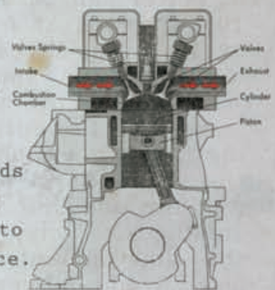

Fig. 2–Engine Fuel System

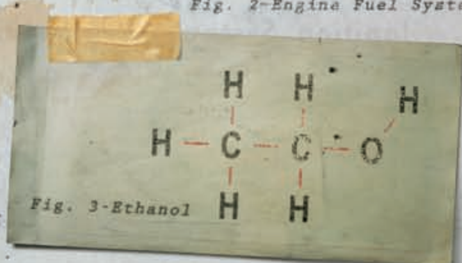
Fig. 3–Ethanol

Ethanol is a solvent that attacks metal surfaces, allowing water in the fuel system to have a faster and more corrosive impact.

Gumout products are specially formulated to prevent corrosion from ethanol and water, helping extend the life of critical engine parts.

Gumout is scientifically proven in the lab, on the track and on the street. See all the ways it can improve your performance at gumout.com.

801B–QR–002

SCIENCE IN. PERFORMANCE OUT.™

GUMOUT® PERFORMANCE ADDITIVES

WHEN IT COMES TO FLUID CONNECTORS: COPY THE ORIGINAL

More than 24 OEMs across the world trust Jiffy-tite fluid fittings for transmission and heat exchange applications. Chances are, whether you are repairing an automatic transmission, or building a replacement heat exchanger, the OE used Jiffy-tite fluid fittings.

So in order to maintain premium quality, copy the original and replace a Jiffy-tite with a Jiffy-tite.

With more than 400 million parts in service worldwide, Jiffy-tite is the global leader in fluid connectors. All Jiffy-tite fittings are 100 percent leak tested and proudly made in America. Jiffy-tite manufactures over 260,000 parts per day, with a wide range of products such as transmission oil cooler fittings, engine oil cooler fittings, glycol connectors, in-line transmission filters and more.

Produced from precision machined aluminum, steel, or injection molded plastic; Jiffy-tite products provide many features and benefits. Improved ergonomics with a simple push-to-connect line set installation. An error proof connection that you can hear, see, and feel. Outstanding performance with 100 percent leak test prior to shipment; guaranteed. Easy to service by disengaging the line set using a disconnect tool. Outstanding value achieved by a low total product cycle cost. Choosing a Jiffy-tite product means you are selecting the same validated and tested solution as the OEMs.

Jiffy-tite's unique Jiffy-Lok® and Jiffy-Seal® innovations save time and improve reliability by eliminating the need for separate hose clamps or joint compound. With Jiffy-tite's engineered quality, you are guaranteed a superior product and happier customers.

Jiffy-tite first started manufacturing fluid fittings more than 50 years ago in 1963. It is Jiffy-tite's continued dedication to quality and total customer satisfaction which has made the company the first name in Quick-Connect fluid fittings for more than five decades. Jiffy-tite continues to lead the fluid transfer industry with innovative solutions and state-of-the-art production processes.

JIFFY-TITE

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Jiffy-tite

FINALLY...OE LEVEL TELEMATICS FOR THE AFTERMARKET REPAIR SHOP

GOLO CarCare from Launch Tech USA gives the aftermarket repair shop the ability to compete with OEM telematics and connected car services.

When a customer's service light (ABS, SRS, Engine…) comes on, customers will typically reach out to their shop to see if they should be concerned or maybe just make an appointment. With Golo CarCare, all codes and data from all modules are transmitted back to the shop's Launch Android Scan Tool, just as if the vehicle were right in the shop, but potentially from hundreds of miles away.

The shop can remotely turn off the light and analyze the data for any recommended "next steps". The GOLO app allows both voice and text communication between the car owner's phone and the Launch Android Scan Tool, all without the cost of an added data plan or fee.

All that is needed is any of the Launch manufactured professional Android Scan Tools (ScanPad 071, ScanPad 101, Pad II) and the GOLO Dongle.

GOLO goes far beyond OBD II Remote Access with its OE level Enhanced coverage including remote access to Enhanced ABS, SRS, Engine, Transmission and body control…. in fact, all modules.

GOLO allows for the customer to be connected to their shop when a service or warning light appears, offering security and peace of mind, ensuring that their shop is the first to be called.

Additionally, GOLO allows the shop to send marketing messages or alerts directly to their GOLO equipped customer base via the shop's web based GOLO Business Manager and the customers GOLO phone app.

GOLO is truly a game changer in the scan tool aftermarket allowing the customer and repair shop to be connected for the first time.

LAUNCH TECH USA INC.

T-562-463-1580
For more information visit **www.golocarcare.com** and **www.launchtechusa.com**

Golo Carcare is compatible with Launch manufactured Android Pro line Scan Tools.

golo CarCare™

LAUNCH

ADDITIONAL BUSINESS WITH DIESEL CARS

The number of diesel cars is growing continuously. These cars have a number of strengths; however a few weaknesses as well. Workshops familiar with these weaknesses and capable of dealing with them can create additional business. LIQUI MOLY shows you how to do this.

In its home country of Germany LIQUI MOLY has collected a wealth of experience with diesel engines for decades. Diesel engines are much more popular in Europe. There; nearly every second car has a diesel engine. Increasing engine performance while simultaneously increasing mileage and reducing emissions certainly has its price. State-of-the-art diesel engines are particularly sensitive in two areas: the quality of the diesel fuel and the motor oil.

If the car has a diesel particulate filter for removing the soot from the exhaust, it is only permissible to use a so-called low SAPS motor oil. SAPS stands for sulfated ash, phosphorus and sulfur. If such an oil is burned in the engine, only a minimum of ash is produced. However if normal oil is used, the quantity of ash produced will quickly clog up the diesel particulate filter, making a visit to the workshop inevitable.

The quality of the diesel fuel is important, because state-of-the-art engines are no longer very tolerant in this respect. Below average fuel quality not only leads to reduced performance and fuel mileage; much graver are the deposits resulting on the injection nozzles from unclean combustion. These accelerate development of additional deposits, which further impair performance and reliability.

These deposits can be removed quickly and easily with LIQUI MOLY Diesel Purge. This cleaning additive can simply be poured into the fuel tank. Another method is even more effective.

If it is necessary to replace the fuel filter anyway, fill the new filter with this additive instead of diesel fuel. This allows the engine to run for a short time on pure additive for particularly thorough cleaning. This method can also be used as a preventative measure during service to eliminate problems before they become clearly perceptible.

Newer model cars are usually equipped with a diesel particulate filter. This is good for the environment, however can cause problems. Many short trips, the wrong oil and below average fuel quality can lead to the filter clogging up prematurely. Now, instead of frustrating customers with expensive replacement, workshops can make points with economical and quick filter cleaning with LIQUI MOLY. With this procedure the filter can remain installed in the vehicle; it is only necessary to screw out the pressure or temperature sensor to obtain access to the filter. Then spray in the special cleaning fluid to dissolve the soot clogging the filter. The entire procedure requires only 30 to 60 minutes. Our LIQUI MOLY diesel particulate filter cleaner was distinguished as the "Best New Product for Import Cars" by the AAIA.

If frequent short trips are the cause for the clogged particulate filter, workshops can also offer customers LIQUI MOLY DPF Protector. Simply pouring this additive into the fuel tank reduces the temperature required to regenerate the particulate filter by nearly 200°F. This ensures automatic regeneration of the filter even during short trips, keeping the filter free for a longer time.

LIQUI MOLY

400 Oser Avenue, Suite 1650
Hauppauge NY 11788
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LIQUI MOLY offers the manufacturer approved motor oil for your BMW.
Since 1957, demanding car owners in Germany have used and trusted LIQUI MOLY. Our Company offers the highest quality motor oils and additives for both gasoline and diesel engines.
Isn't it time YOU discover LIQUI MOLY?
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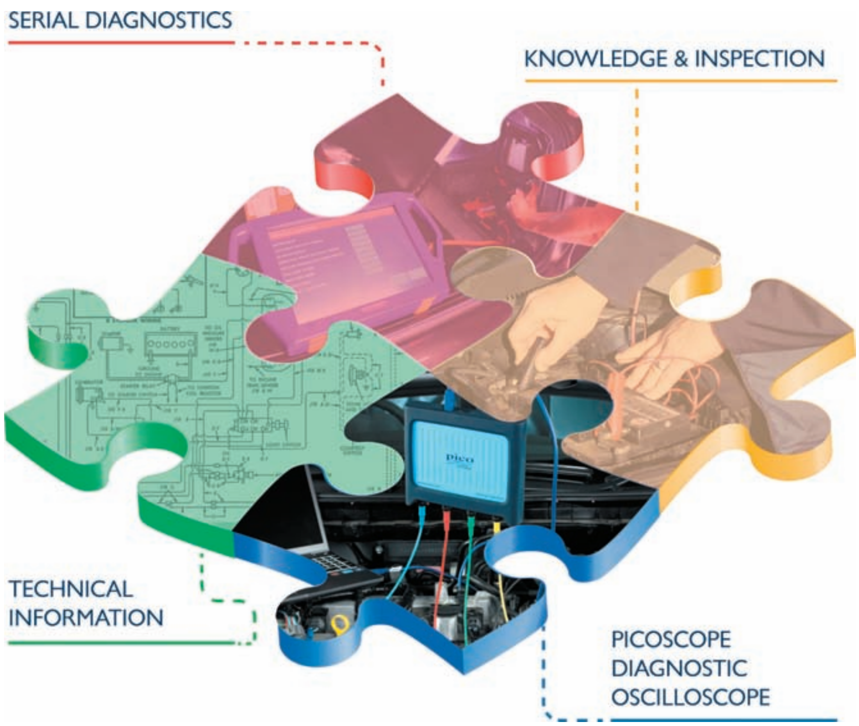
FIXING IT RIGHT THE FIRST TIME

This headline can mean different things to different techs. To some it means picking the right part to swap out when doing a repair. To others it is a much more complex solution, involving them to research how the system actually works, using a combination of high priced tools to prove the faulty component is causing the root issue and then finally replacing that part. We get asked all the time, why do I need a scope? The answer is simple – if you don't use one in your diagnostic solution, most likely you don't. Most auto parts stores will perform a free code read on your vehicle also, so you don't really need a scanner either. Scopes and scanners go hand in hand in effectively diagnosing vehicles correctly the first time. Can you trust that the sensor the computer thinks is faulty actually is? You could if you ignore all the situations you have run into where you have had to repair broken wiring, bad terminals, and faulty ECM's. Do you need to pull out a scope every time you pull a vehicle into the bay? If you wrap your test leads around the oil filter multiple times, they can act like a good filter wrench. If you are just getting into using a scope, it might be a good idea to pull it out for a while though and hook up to known good circuits while you are waiting on parts to arrive etc. Viewing waveforms from good systems and learning them allows you to spot bad components quicker and easier when it does come time to inspect that next intermittent fault.



Does your scope reset Air Bag codes?

Scanners and scopes are only one piece of the puzzle. The big piece that you will need is the knowledge piece. If you don't know how a system or a tool works, step away. Don't even look at the car until you have gotten onto your information system and learned how the circuit is supposed to perform when it works normally. This can be your aftermarket information system, the factory manuals or community based forums such as iATN.com. Learn all that you can about the system, formulate a test procedure in your head and only then go back to the vehicle and work on it. Without having a plan to start with, you are starting yourself up to fail. Does your city have any local training events? Most major part chains hold regular training sessions that you can look into. Recently Automechanika Chicago and VisionKC were held – were you there? These are some of the best training events that are held where you can learn everything from how new and upcoming technology works, how to use you scopes and scan tool effectively to how to manage and promote your shop better.

Maintaining yourself at the top of your game in this ever changing industry is a difficult task to master. We are in one of the few fields that have to invest tens of thousands of dollars in equipment to take pride in our work and do the job right for the customer and still have to compete with anybody and the internet that thinks that they know what they are doing. The public needs to learn to demand for ASE certifications. What can you do to help the industry? Be part of the solution for the consumer and help educate them the need for licensing and going to a shop that spends their hard earned dollars to reinvest in tools and training. Help earn their trust by fixing it right the first time.

PICO TECHNOLOGY

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Tyler TX 75702
P-800-591-2796
www.picotech.com

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TIPS FOR SPARK PLUG REMOVAL

The spark plug is a key engine system component: it serves to create the electric spark which ignites the compressed air-fuel mixture in an engine cylinder to fire up the engine. A properly functioning spark plug helps reliable starting, guarantees that there is no misfiring, and operates under extreme conditions. Removal or installation of spark plugs on modern vehicles requires extreme precision and care.

Each vehicle has a specific change interval for spark plugs recommended by the manufacturer. Not changing the spark plugs at recommended intervals, or replacing them with lower quality spark plugs can lead to a decrease in engine peformance and can compromise the life of the plug. It is, therefore, important to advise your customers to use original equipment quality or better metallurgy spark plugs and to replace them at the manufacturer's recommended service interval for proper engine performance.

Before removing a spark plug check to see if it is still working properly and whether the engine itself is in good working condition -- since both go hand in hand. If the spark plug has excess carbon deposit on it or if it is oil fouled it could be an indication that the engine isn't running properly which could be due to a number of possible causes. While replacing the worn spark plug can be a temporary fix, it is always better to fix the root cause to ensure that the spark plug doesn't get damaged again.

Before attempting to remove the spark plugs on a vehicle, we highly recommend that you first determine any special instructions by the vehicle's manufacturer for accessing the spark plugs because engines can vary widely by make and model.

Next, you need to have a few very important tools on hand to ensure that damage does not occur to the spark plugs during the removal process. These include a ratcheting socket wrench,a socket extension, and a spark plug socket. A standard deep-well socket should not be used, as it can crack the ceramic insulator. You will also need a torque wrench that is able to measure as low as 10 pounds per square foot. You may need additional tools depending on the vehicle's configuration.

Then, make sure the engine is off and is cool. Engine components can be very hot after running, so be cautious throughout the removal process. Be sure to wear proper protective equipment, including safety glasses and sturdy gloves.

There are two different types of spark plug connections in cars: spark plug wires and "coil on plug." If you have spark plug wires, simply pull the boot off from the base. Make sure you do not tug on the wire too hard as it could cause damage.

With coils, you may have to remove some fasteners. Once you've done this, simply tug the coil off. If you're removing all of the wires or coils at once, mark the spark plug wires or coils to ensure you replace them in the proper sequence.

Use a spark plug socket to remove the spark plugs with an extension if needed. Do not use a standard deep-well socket, as it can damage the spark plug. Make sure the socket is the same hex size as the spark plug.

Loosen the spark plugs one or two turns, then clean the surrounding area at this time to prevent dirt particles and debris from getting into the threads or the combustion chamber. You may need to apply some force if the worn plug is rusted and wasn't installed properly previously.

If the spark plug is extremely tight, loosen it only a little and use penetrating oil on the threads. Let it sit for about five minutes to allow the oil to penetrate and then attempt to remove it again.

Once you have completed the job safely and correctly, dispose of the old plugs according to state and local ordinances.

For information on the entire portfolio of Bosch Spark Plugs, **visit www.boschautoparts.com/auto/spark-plugs.**

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Invented for life

WHEN DO I NEED A HUB KIT?

As the number of types of vehicles on the road today proliferates, so, too, does the number of different types of wheel bearings.

One common type is called a Generation 1 wheel bearing, which features a double row angular contact ball or taper bearing.

Like all bearings, these are subject to wear and damage over time that might eventually require replacement.

Before a bearing is replaced, take a close look at the wheel flange and the related components. A bent or damaged wheel flange is often the cause of wheel bearing failure, but is frequently overlooked.

Visual inspection is the first step in checking the wheel flange; also note any excessive wear along the shaft. A dial indicator can be used to check the wheel flange for excessive run out.

If a wheel flange is cracked at its base, the damage is usually severe, so it should be replaced. If replacement is needed, SKF offers a variety of hub kits that include the wheel flange, Generation 1 bearing and additional components.

Nearly 90 million vehicles worldwide ride on SKF wheel bearings and hub units, which is more than all other brands combined. All SKF hub bearings are premium-quality parts manufactured using high-quality steel and surface finishes, premium seals, OE grade sensors, precision manufacturing techniques and precise assembly tolerances. Each is tested to original OE specifications for fit, form and function.

In servicing these types of wheel bearings, care should be taken during the installation process, as proper installation will help promote longer life of the replacement bearing.

Make sure to incorporate additional wheel-bearing grease if needed.

Press the bearing into the steering knuckle by use of proper tools, then press the bearing on the outer ring.

Next press the wheel flange, again using the proper tools.

Finally, follow the recommended axle nut torque specification.

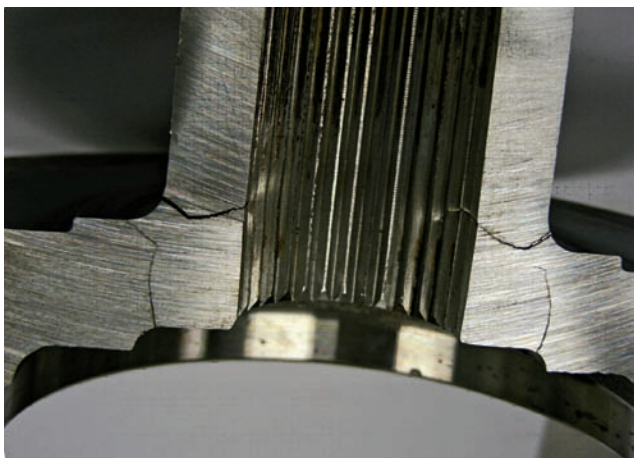
While this article focuses on Generation 1 wheel bearings, SKF also offers a variety of other common wheel bearings.

Generation 2 hub bearings have an outer ring with an integral flange, replacing the function of a separate hub. The flanged outer ring serves as a lightweight structural component and incorporates threaded holes or studs to center and mount both brake and wheel. They are most commonly found on non-driven front or rear wheels.

Meantime, Generation 3 hub bearings have a flange for wheel and brake attachment, while a second flange fixes the unit to the suspension. They are typically used for both driven and non-driven wheel applications. Torque is transmitted to the inner ring via an included spline in driven-wheel applications.

And there are X-Tracker hub bearings, a patented and exclusive design Generation 3 hub bearing. These consist of a double row angular contact ball bearing arrangement, in which the outboard row is at a higher diameter and contains more balls than the inner row. This increases the bearing's capacity, while improving hub stiffness 50 percent over a traditional tapered bearing unit.

For more information about SKF hub bearing units and kits, **visit www.vsm.skf.com.**



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SHIFT TO ALL-IN-ONE

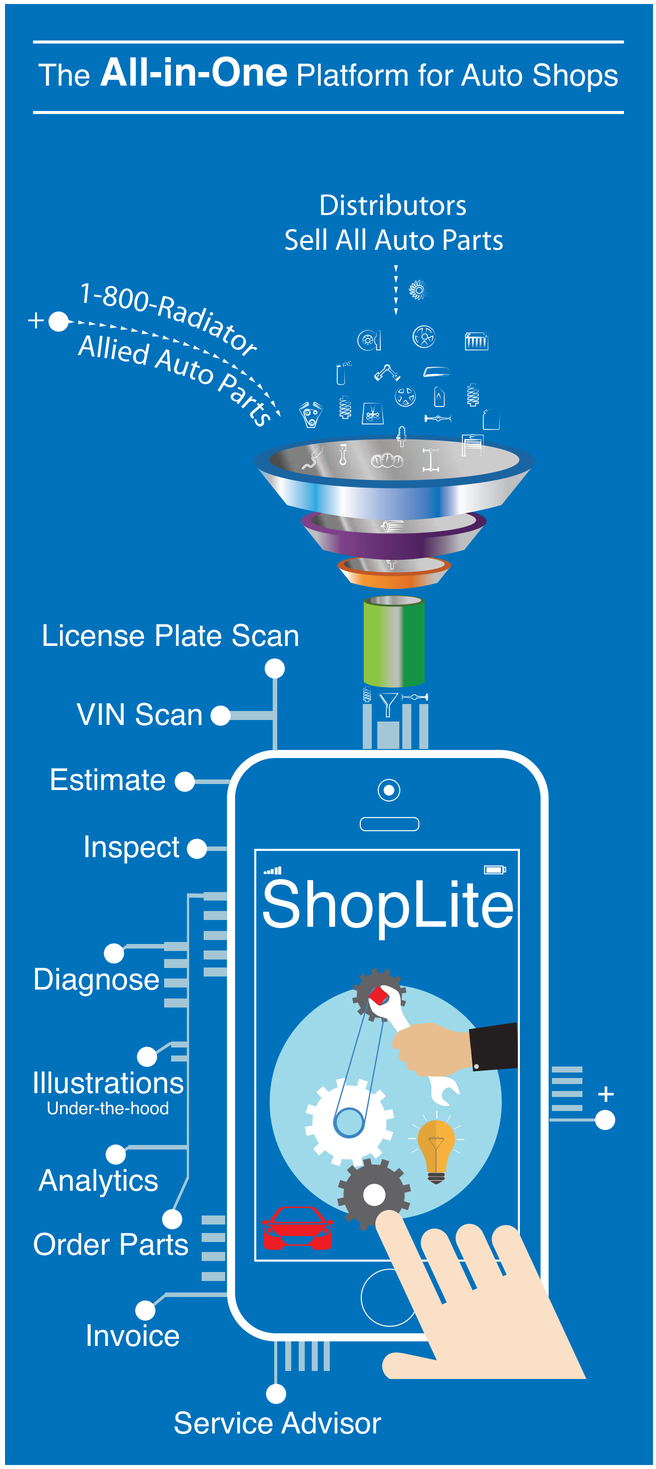
Of the millions of smartphone owners in the United States today, 96 percent use mobile apps. That includes more than 200 million workers who rely on mobile business apps. With numbers like these, the need for mobile innovation in the $146 billion automotive parts aftermarket industry is clear.

SHIFTMobility ShopLite™ is an all-in-one mobile application that helps service centers across the nation manage their business activities, engage customers, market their services, and run more efficiently. To stay competitive, today's shops must be able to estimate needs, order parts, and track deliveries from anywhere at any time. Take Bob, for instance, who just dropped off his children at school. Using ShopLite, he can get a quote for a service job, order the necessary parts, and get them delivered while he is still on his way to the shop. Say goodbye to searching through 20-odd part distributor portals to locate a specific part number. ShopLite's license and VIN scan feature ensures that Bob will order the right part for the right car every time, reducing return rates and enabling him to service more cars.

For distributors, it's just as simple. Look up product lines, update them with availability and price information, and start selling. ShopLite has millions of parts from the most up-to-date catalogs and is optimized for the mobile experience. Using its advanced reporting, distributors will be able to know their inventory levels at a glance and administer special pricing. Built-in analytics provide powerful insight into demand so that the right parts can be stocked in the right warehouse for every territory.

With the right parts on hand to complete the job, ShopLite serves as a centralized clearinghouse for the instructions, diagrams, and technical data necessary to repair vehicles from every major car manufacturer. Service centers and customers alike will benefit from the convenience and efficiency that ShopLite offers.

ShopLite is the only platform you'll ever need to manage your shop, order parts, and successfully engage your customers - anywhere, anytime.



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CATCHING UP WITH TECHSMART® THE AFTERMARKET'S PROBLEM SOLVER

The shift to electronic engine components has changed what's under the hood of an automobile. Case in point: now you'll find very complex engine controls and computer chips. Like the old parts, though, the 'new-tech' products need high-quality replacements. TechSmart meets the demand for high-tech replacement parts. Its product line covers more than 80 key engine management categories, including electronic throttle bodies, distributor assemblies, and variable valve timing components. Over the past few years the brand has been carving out a niche as a problem solver for the automotive aftermarket.

Good Aftermarket Genes

TechSmart belongs to the Standard Motor Products family of brands. SMP has been a leader of the automotive aftermarket industry for more than 95 years, so it's no surprise to learn that TechSmart shares core SMP® qualities such as innovation, engineering expertise, product quality, and testing. With SMP's guidance and resources, TechSmart is able to pinpoint problems that technicians face in the bay and quickly bring to market products that address said problems. In turn, SMP gets an in-house testing ground for future product lines. The real beneficiary, however, of TechSmart and SMP's relationship is the professional automotive technician. They receive a high-quality replacement part that's tested to ensure performance and durability. But first the part has to be made.

Engineering Solutions

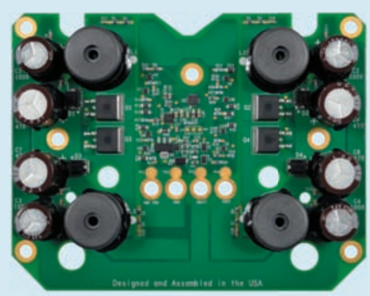
The key to TechSmart's success begins in its engineering and design centers. There, a skilled team of engineers helps carry out the brand's mission of helping professional automotive technicians solve problems faced in the bay, work more efficiently, and be more successful. Depending on the problem, the solution could require the engineers to introduce a new technology, re-engineer a solution to a current OE problem, or even pioneer a new part category altogether. In general, TechSmart focuses on parts with high failure rates, parts that are difficult to find, and parts that are only available from the dealer. But with a talented team of engineers and state-of-the-art testing and manufacturing facilities at its disposal (such as its advanced electronics manufacturing facility in Orlando, Florida), TechSmart is capable of engineering solutions to nearly any problem encountered by professional technicians in their shops. That's how TechSmart has become the automotive aftermarket's problem solver.

TechSmart SMP®

TECHSMART

www.techsmartparts.com

Solving the FICM Problem



Every part TechSmart puts into one of its boxes is a direct result of a conversation with a professional technician. Take the story of its Fuel Injection Control Module as an example. For several Ford applications, the electronics on the OE and competition's part overheated and failed. To give technicians a superior part to install, TechSmart's engineers redesigned the FICM's circuit board and gave it higher-quality electronics. The result was a Fuel Injection Control Module that distributed heat more evenly, keeping critical components cooler and preventing heat failure.

TRICO: THE LEADER IN WIPER INNOVATION

In today's need-it-now marketplace, it's not enough for a wiper manufacturer to produce technologically advanced products that keep pace with improvements made in vehicle design and driver preferences. To stand above the rest, a wiper manufacturer must also develop effective ways to guide consumers through the purchase process and ultimately help automotive service professionals close the sale.

Trico Products has embraced this expanded role by continuously engineering new wiper products that aid in safer driving.

Original Look, Superior Performance

Many consumers simply want to restore their vehicles back to original factory performance, fit and look. That's why Trico Products has developed the TRICO Factory Replacement Center®, a program that makes it easy to find and install the TRICO Exact Fit® blade specifically designed for each driver's vehicle.

The TRICO Factory Replacement Center features a newly expanded line of TRICO Exact Fit blades including beam, hybrid, conventional and rear blades that provide unmatched coverage for nearly 98 percent of consumer vehicles on the road today. Leveraging close relationships with OEMs, TRICO Exact Fit blades are designed to provide the fit, form and function of original equipment right out of the package.

In fact, the TRICO Factory Replacement Center now includes a 29-inch beam blade to suit BMW and Ford models, and blade lengths from 19 to 26 inches that fit the new narrow Push Button arms found on Audi, Porsche and Volkswagen models. Additionally, three new rear integral blades have been added to fit 3.9 million vehicles including leading Ford, Honda, Infiniti, Lincoln, Mercedes-Benz and Nissan models.

Trico Products offers five TRICO Exact Fit rear windshield beam blades to fit 2004 through 2014 models of Audi, BMW, Ford, Volkswagen and Volvo vehicles. The line features five arm designs including V-Notch, Cross Pin, Push Button, Pinch Tab and Trunnion. To make installation a snap, TRICO Exact Fit wiper blades are pre-assembled with the specific adaptor for the consumer's vehicle, eliminating the fuss of multiple adaptors and complicated instructions.

A Winter Weather Fighter

Although beam blades are considered an all-season wiper, TRICO invented the winter blade in 1953 and has recently perfected it with TRICO Ice®.

Providing maximum performance in the most unrelentingly harsh conditions, TRICO Ice features a wedge-shaped spoiler that clears away snow and ice buildup. This new design conforms to windshield shapes to distribute even pressure for a clear wipe, while the low-profile contour complements new vehicle models and maximizes line of sight.

A form-fitted boot guards critical wiper components, yet allows complete flexibility. The wiper element, infused with Teflon® surface protector, helps resist tearing and ripping in sub-zero temperatures to battle the elements and eliminate chatter for a smoother, quieter wipe.

Many Options, One Single Resource for Wiper Products

As consumer demands and automobile technology constantly evolve, Trico Products offers a full selection of advanced products and high-impact merchandising programs to support service technicians and counter professionals. TRICO. Seeing you through®.

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MAXIMUM WIPER PRESSURE

WORLDPAC TRAINING INSTITUTE PROVIDES ADVANCED TECHNICAL, BUSINESS EDUCATION

WORLDPAC Inc. and the WORLDPAC Training Institute (WTI), the company's division focused solely on providing the Aftermarket with the highest quality advanced technical and business training available in the industry, are committed to supporting independent professionals through education.

"Our mission at the WORLDPAC Training Institute (WTI) is to assist customers in growing and increasing the profitability of their business through education," says Mario Recchia, WORLDPAC Senior VP of Marketing. "WTI course materials are created explicitly for the independent service center, and are designed and taught by our experienced, professional automotive instructors. Our goal is to establish and maintain relationships with our customers that generate long-term sustainable value."

The WTI technical training program provides advanced level diagnostic training for independent repair professionals. The complexities of properly diagnosing and repairing late model vehicles requires training that, until recently, has not been readily available to independent service center professionals.

The WTI business development program provides training in the management of the repair shop business. The tools provided in these classes help managers increase productivity, increase profits, and assist with improving troubled areas of the business.

Established in 1997, the WORLDPAC Training Institute (WTI) has trained over 50,000 independent repair professionals. WTI also conducts a biennial Supplier & Training Expo (STX) that currently hosts over 1000 WORLDPAC customers and offers 1000 total hours of training presented by more than 50 of the industry's most respected instructors.

"WORLDPAC is dedicated to providing our customers the very best training in our industry," said Bob Cushing, WORLDPAC President and CEO. "We take great pride in continuing to offer training curriculum designed to meet the demands of growing the independent repair professional's business."

"WORLDPAC's approach is a total value proposition focused on an ease of doing business." says Mario Recchia. "We have a vested interest in the success of our customer. The WORLDPAC Training Institute (WTI) is a great opportunity to help us better serve their needs now and in the future."

The WORLDPAC Training Institute (WTI) is just one part of WORLDPAC's total value proposition. The company specializes in an advanced wholesale distribution model with complete inventory of original equipment automotive parts for import and domestic vehicles, as well as a comprehensive WORLDPAC Tools & Equipment Services (TES) division. WORLDPAC also offers a suite of amenities such as speedDIAL, the company's industry leading online catalog and fulfillment ordering software, the WORLDPAC app and VIN scanner, OE Detailed Schematic Parts Diagrams, proprietary Digital Delivery systems, customer marketing solutions (CMS), and a vast company-owned fleet of vehicles and drivers providing multiple same-day deliveries from over 100 regional distribution locations across the USA, Canada and Puerto Rico.

Headquartered in Newark, CA. USA, WORLDPAC is an importer and distributor for original equipment and quality aftermarket replacement automotive parts. With over 120,000 sku's and 11 million applications covering 40 plus car lines, the company provides brand recognized automotive parts directly to independent import and domestic service centers in the US, Canada and Puerto Rico, and also offers customer services such as their highly praised technical and business training, as well as targeted marketing solutions.

WORLDPAC, INC.

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www.NAPAdrivetech.com
NAPA Auto Parts

TECHNICIAN REPAIR INFORMATION TOOL

MotoLOGIC Repair & Diagnostics is a web-based tool for automotive technicians, featuring unedited OE repair and diagnostic information for most major manufacturers. Its advanced search function delivers instant results based on virtually any search criteria and includes more than 26 million articles of repair and diagnostic information.

For more information, visit
www.motoshop.com/motologic
MOTOSHOP Technology Tools

HOOD CLAMP

ShockLock is the safest solution for failed gas struts. It is a heavy-duty tool to prevent injuries to technicians and vehicle owners from vehicle hatches like hoods and trunks, which can collapse when the gas struts are worn out or have completely failed. ShockLock supports vehicle hatches weighing up to 100 lbs., easily secures failed struts in place with one hand, optimizes safety for drivers, technicians and service firms and takes the place of pliers and propping sticks. ShockLock reduces vehicle damage liability, while optimizing engine workspace.

For more information, visit
www.shocklock.ca
Ansik Automotive

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Easy-Run Engine Test Stands are the perfect solution for starting up and testing engines before they are installed in a vehicle. These high quality, fully adjustable stands are engineered for universal applications and made available with a variety of mounts for quick and easy set up of most domestic and foreign engines. An adapter kit enables mounting of automatic transmissions. Rugged welded steel tube frame is proven to safely handle 1,000-plus horsepower engines. Available preassembled with a position adjustable gauge and switch panel, cooling system, electrical system, battery tray with battery and starter cables, starter solenoid, fuel tank, and other options.

For more information, visit ***www.easy-run.net***
Easy-Run Engine Test Stands

CAR LIFT ACCESSORY

Rotary Lift introduces LockLight™, a patent-pending new lift accessory that shows technicians, shop managers and health/safety inspectors at a glance if a vehicle lift is resting on its locks. Every time a technician raises a vehicle for service on a lift, standard industry safety practices require that the lift be "lowered to locks" before starting work. To do this, the vehicle is raised to slightly above working height, and then lowered a bit until the lift locks engage. This process relieves the lift's hydraulic pressure and places the load of the vehicle securely on mechanical safety latches. Doing so reduces the chance of the vehicle freefalling if the lift system fails.

www.rotarylift.com
Rotary Lift

CORDLESS IMPACT

The new Snap-on® 18 Volt 3/8-inch Cordless Impact (CT8810A) may be compact in size but is a monster performer. Providing more torque than competitive units, the CT8810A features a slender design and balanced ergonomic control, making it easy to use for long periods of time without getting fatigued.The new Snap-on 18 Volt 3/8-inch Drive Lithium Impact (CT8810A) includes a built-in one-watt LED that projects light directly onto the work area, increasing visibility and expediting the job. Providing 3,480 blows per minute and 2,400 RPMs for free speed to quickly break fasteners loose, the CT8810A also has a digital fuel gauge and microcontroller to sense temperature and amperage, cutting off power to the motor before it can overheat.

www.snapon.com/powertools
Snap-on Tools

BRAKE PADS

In response to legislation requiring the reduction of copper in brake friction formulations, Bosch, the worldwide leader in braking technology, has announced that it now offers copper-free material in its premium-grade QuietCast™ as well as its other lines of braking products. Furthermore, Bosch has developed a proprietary copper-free ceramic friction formulation that incorporates renewable materials to make its product even more environmentally-friendly.The revolutionary new design and technology behind this new Bosch proprietary copper-free ceramic brake friction formulation are significant industry developments. Bosch has filed for patent protection in North America and other key markets.

www.boschautoparts.com/brakes
Bosch

TORQUE MULTIPLIER

K-Tool International has added the KTI72190 Torque Multiplier to its product line. With a 3/4" drive input (maximum 730 ft. /lb.) and a 1" drive output (maximum 2200 ft. /lb.) the torque multiplier provides the operator with nut-turning power that requires only a fraction of the force required when using conventional tools. The KTI72190 increases the torque range 3:1. It comes in a convenient plastic, blow-molded storage case and has a one-year warranty.

www.ktoolinternational.com
K-Tool International

PREMIUM CALIPERS

CARDONE Industries, Inc. introduces CARDONE UltraTM Premium Calipers, the company's new brand of premium remanufactured calipers that features an exclusive, silver coating to protect against rust and corrosion. Backed by over 45 years of remanufacturing expertise, these calipers offer reliable performance and peace of mind, as well as a premium appearance that complements all wheel types. The Calipers also come equipped with all the necessary installation hardware, including a new banjo bolt and mounting bracket on all applicable applications. Over 500 part numbers covering the most in-demand applications are available today through MyCARDONE, the company's online customer portal, and industry e-catalogs.

www.cardoneultra.com
CARDONE Industries

LEAK DETECTION KIT

The Tracerline® EZ-Ject™ A/C and Fluid Kit (part no. TP-8657) pinpoints leaks in A/C and fluid systems. It features the only concentrated, premium-quality, OEM-approved fluorescent dyes in the industry. The dyes are used and approved by more major OEM manufacturers than any other brand. The star of the kit is the TP-8655 OPTI-PRO™ Plus, a cordless, "true UV" (violet light) LED leak detection flashlight with convenient on-board recharging. It emits less visible light, making leaks clearer and easier to spot. Its high-output LED provides optimal fluorescent dye response and contrast, ensuring that every leak glows brilliantly. Also included in the kit are an EZ-Ject™ A/C dye injector assembly with hose and coupler, a 0.5 oz EZ-Ject R-134a/PAG multi-dose A/C dye cartridge for servicing up to 14 vehicles, a 1 oz bottle of Dye-Lite® All-In-One™ full-spectrum dye for all oil-based fluid systems, a 1 oz bottle of Dye-Lite Rite-Blend™ extended-life coolant dye, a smart AC charger and fluorescence-enhancing glasses. All components are packed in a sturdy carrying case.

www.tracerline.com
Tracerline

PARTS GUIDE

Dorman Products, Inc. has launched its new 2015 Service Dealer Guide, Volume 1. This new guide features over 180 new formerly 'Dealer Only' parts – now available through the aftermarket. These exclusive new Dorman parts reduce dependency on the OE Dealer and give customers at all levels a better choice in automotive replacement parts. Highlights from the new Service Dealer Guide include Dorman's new offering of pre-formed Stainless Steel Brake Line Kits, Console Lids, Transmission Control Modules, Door Latch Actuator Motors, Differential Mounts, Leaf Spring Shackle Kits, HVAC Control Modules, Hybrid Drive Batteries, Hybrid Inverter Assemblies and many more. Epicor and Wrenchhead line codes have been included to make it easy to locate Dorman's latest part introductions in ecat systems.

www.dormanproducts.com
Dorman Products

DRIVE KITS

ContiTech is systematically continuing its kit strategy and adding accessory drive kits to its range for the automotive aftermarket. Dealers and workshops can order the kits now. The new ContiTech accessory drive kits contain multiple V-ribbed belts and the required tensioner and idler pulleys in OEM quality. Depending on the application, the kits also contain dampers and small components. With around 100 complete packages, the specialist for belt drive components is covering the most frequent applications.been included to make it easy to locate Dorman's latest part introductions in ecat systems.

www.contitech.de
ContiTech

ELECTRIC FUEL PUMPS

Performance automotive manufacturing company Mr. Gasket, has introduced a line of Micro Electric Fuel Pumps for a wide range of import and domestic gasoline, diesel, ethanol, methanol and E85 fuel applications. These electric fuel pumps provide auxiliary fuel flow for carbureted engines, helping to combat vapor lock by providing consistent and reliable fuel delivery. Each Micro Electric Fuel Pump is a self-priming gravity fed pump, featuring a low amperage draw design with solid state electronics that's lightweight and ideal for providing fuel delivery in carbureted street cars and trucks, as well as transferring fuel between auxiliary tanks in trucks and commercial usage.

www.mr-gasket.com
Mr. Gasket

CIRCUIT TESTER

The Monster brand is available exclusively through the mobile tool distribution channel. The Digital LCD Circuit Tester 12-48V DC (Part No.MST12001) is used to detect voltage, power, ground and circuit integrity. This incredibly versatile tool has a larger testing range than most testers on the market allowing professional technician to test voltages from 12 volts all the way up to 48 volts DC. It's made with an LED indication, red for power and green for ground. The handle is a single-piece design formed from a ballistic poly-carbonate material and houses an LCD display that provides a "no guess" voltage value of circuit. The LCD screen is back lit with large digits and shows values in whole or decimal outputs as low as .1V. It's designed with a stainless steel testing probe for reliable readings and a coil cable which extends up to 12 feet. The Digital LCD Circuit Tester (Part No.MST12001) includes a one year warranty on materials and workmanship. Also available in 6 – 24V DC is the MST12002.

monsterautotools.blogspot.com
Monster

DIESEL INJECTOR CLEANER

AMSOIL has introduced a convenient single-use package size for AMSOIL Diesel Injector Clean to round out its line of premium diesel additives. The new 8-oz. bottle is ideal for applications requiring 15-20 gallons of fuel. AMSOIL Diesel Injector Clean is formulated with a concentrated alcohol-free chemistry that provides optimized performance in diesel applications. It removes performance robbing deposits found in fuel injectors and the combustion chamber. These deposits have become increasingly troublesome for high pressure common rail diesel engines. Diesel Injector Clean maintains cleanliness and controls wear to fuel pumps and injectors. For larger diesel fuel tanks, AMSOIL continues to offer Diesel Injector Clean in 16-oz., 64-oz. and bulk quantities.e MST12002.

www.amsoil.com
AMSOIL

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TRAINING

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ATS

COMMERCIAL LIGHTS

Horpol is the Polish producer of lights and reflective devices used in commercial vehicles. Our lamps have approvals granted by the European certification centers. The company has its own design office and photometric laboratory. The tools, including injection moulds, are also designed and produced at our premises in Lipniki, which allows us to customize our products.

Horpol

STEEL TOE BOOTS

Redback USA now offers the Easy Escape Steel Toe boot with a protective scuff cap. The 6" slip-on is one of our most popular boots and now the toe leather will be protected from scuffing and tearing with the new molded Thermo Plastic Poly-urethane toe cap. The USBBKSC will continue to provide you with the anatomic support, PU shock absorbing midsoles and TPU outsoles that are oil/acid slip resistant for maximum grip on all types of terrain.

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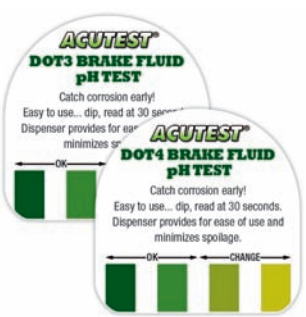
www.Ardeca-Lubricants.be

Ardeca oil's burn-off/oil consumption ratio is ½ to 1/8 of other leading oil brands in the U.S. For modern cars oil burn-off is a big problem. End users are looking for a premium product to address this issue. As long as the proper grade of Ardeca oil is used, oil does not need to be added within the oil change interval. This makes Ardeca unique among all other brands. Visit www.ardecausa.com for more information.

Ardeca Lubricants USA

BRAKE TECHNOLOGY



Innovative, cutting-edge ACUSTRIP patent-pending brake technology is easy to use and provides fast, reliable results to determine potentially harmful, unsafe or damaging conditions in less than a minute. Identify the need for service, show the customer the result so they can participate in the service decision. Build confidence and your bottom line. Visit www.acustrip.com for more information.

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Temel Gaskets offers the latest technology in gasket design with all metal body stamped by complete steel stamping tools, providing the highest precision with each product. Along with the wide range of existing products, new product development projects are ongoing activities at Temel Gaskets. Combined with over 40 years of expertise, Temel Gaskets is the trusted source for OEMs and aftermarket distributors. Visit www.temelgaskets.com.

Temel Gaskets

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Command the power of INVISIBLE HEAT with the Mini-Ductor II. Heat nuts and bolts red hot in seconds without a flame! Use high-frequency magnetic fields to provide precise heat for the easy removal of hardware and components from corrosion or thread lock compounds, including bearings, ball joints, tie rods, manifold bolts and more. The Mini-Ductor II helps technicians work more efficiently than with a torch.

Induction Innovations

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Powerful Tools for Shop Management

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WHERE'S THE HOLE?

USING NEW TECHNIQUES TO SOLVE AN OLD PROBLEM

BY **PETE MEIER**
Technical Editor

How many of you remember the days of automotive A/C systems that held three or four pounds of refrigerant? Back then, it was considered acceptable to lose half an ounce of refrigerant per year from a single leak source. Move the clock forward to modern times, though, and you'll discover that today's systems are not quite so forgiving. There are numerous models now that use less than one pound of refrigerant to fully charge their systems. Even small leaks can quickly impact system performance, resulting in your customer's return to the shop at the tail end of the season after having it repaired (or so we all thought) at the beginning of the season. And in some parts of the country, there is no season! The demand for a functional A/C system is year round.

Recovery/recycling/recharge (RRR) equipment can be used to check for the presence of a system leak, and on vehicles equipped with R1234yf, it is a required step. But the machine can't tell you WHERE the leak is. To find the exact location, many of us prefer the use of a refrigerant "sniffer" – a device that detects the presence of refrigerant in the air around the A/C components (if a leak is present).

At least, that's the idea. Older sniffers would trigger on just about anything and a few years back, the SAE issued improved standards that helped quite a bit. But if your shop is like any of the ones I've worked in during my career, other factors (like the breeze kicked up by shop fans on a hot summer day) limited the effectiveness of this method when hunting elusive leaks.

Dye is another popular method and can be very effective. One of the drawbacks of dye is the amount of time it takes to circulate through the entire system. Another is the danger of overdosing the system – adding dye to one that has already received a few shots of the stuff. A third is being able to see the whole system, especially the evaporator core, a common source of leaks.

So what do you do to chase down a stubborn, hard-to-find leak source? There are alternatives, and in this edition of The Trainer, we'll take a look at the use of ultrasound and CO_2 for leak detection, as well as offer you some tips on using the more conventional methods more successfully. MA

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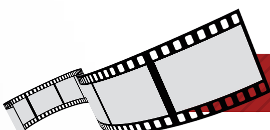

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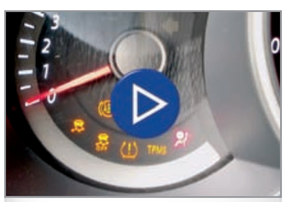

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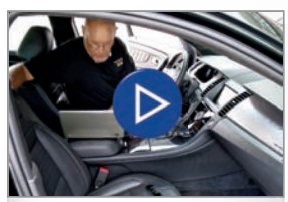

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