

# Motor Age

March 2015

Talk Shop Anytime



AUTOPRO WORKSHOP

Vol. 134, No. 3

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# MotorAge

## EDITORIAL STAFF

Group Content Director  
Michael Willins  
mwillins@advanstar.com  
(440) 891-2604  
Managing Editor  
Tschanen Brandyberry  
tbrandyberry@advanstar.com  
(440) 891-2745  
Technical Editor  
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

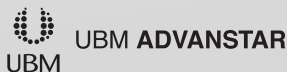
(888) 527-7008  
(218) 740-6395

## 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



Printed in U.S.A.



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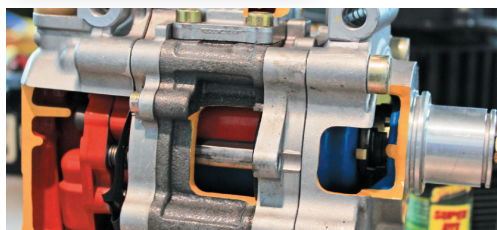
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**Motor Age** (Print ISSN: 1520-9385, Digital ISSN: 1558-2892) is published monthly, by UBM Advanstar, 131 W. 1st Street, Duluth, MN 55802-2065. Periodicals postage paid at Duluth, MN 55806 and additional mailing offices. **POSTMASTER:** Send address changes to **Motor Age**, P.O. Box 6019, Duluth, MN 55806-6019. Please address subscription mail to Motor Age, 131 W. 1st Street, Duluth, MN 55802-2065. Canadian G.T.S. number: R-124213133RT001. Publications Mail Agreement Number 40612608. Return Undeliverable Canadian Addresses to: IMEX Global Solutions PO Box 25542 London, ON N6C 6B2 CANADA One-year rates for non-qualified subscriptions: U.S. \$70.00; Canada/Mexico \$106.00; International surface \$106.00. For information please call (866) 529-2922 (Domestic inquiries); (218) 740-6395 (Canadian/Foreign). **Printed in the U.S.A.**

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## SALES STAFF

**Midwest/Western/Northern California**  
Chuck Steinke, Regional Sales Manager  
Tel: (630) 369-0752  
Fax: (630) 369-3755  
[csteinke@advanstar.com](mailto:csteinke@advanstar.com)

**Eastern/Southern States**  
Paul A. Ropski, Regional Sales Manager  
Tel: (312) 566-9885  
Fax: (312) 566-9884  
[propski@advanstar.com](mailto:propski@advanstar.com)

**Ohio/Michigan/Southern California**  
Lisa Mend, Regional Sales Manager  
Tel: (773) 866-1514  
Fax: (773) 866-1314  
[lmend@advanstar.com](mailto:lmend@advanstar.com)

## Inside Sales/Classified Sales/Recruitment

Keith Havemann, Sales Representative  
Tel: (310) 857-7634  
Fax: (310) 943-1465  
[khavemann@advanstar.com](mailto:khavemann@advanstar.com)

## POWERTRAIN PRO

Michael Parra, National Sales Manager  
[michael.parra17@gmail.com](mailto:michael.parra17@gmail.com)

## List Rental Sales

Tamara Phillips  
[tphillips@advanstar.com](mailto:tphillips@advanstar.com)  
(440) 891-2773

## Permissions/International Licensing

Maureen Cannon  
(440) 891-2742

## Reprint Services

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CERTIFICATION OPTIONS

## GET CERTIFIED IN CHICAGO:

### AUTOMECHANIKA CHICAGO TRAINING PERKS

Automechanika Chicago Presents Motor Age Training Live already is a world-class training event, offering more than 100 sessions led by more than 50 of the best instructors in the business. What could make it better?

How about certification? Each class attendee will be provided a certificate of their attendance. If you're an educator, classes you attend at Automechanika Chicago (AMC) can be used for your CE credit requirements. If you're not, think how impressed customers will be seeing all those training certificates hanging in your shop's customer waiting area. Here are some of the certifications you can take advantage of.

#### ASE Certification

- First come, first served tests
- Register at [www.ASE.com/Automechanika](http://www.ASE.com/Automechanika)
- Testing location at AMC TBA

#### NATEF

- Technical course attendees can submit course completion certificates for credit toward NATEF program accreditation training hour requirements.
- Course locations TBA.

#### MACS 609

- Exam is Sunday, April 26
- \$15 fee due at the door
- Location at AMC TBA



Trainers and technicians listen to a class at PACE Automechanika in Mexico City.

### TRAINING

## Hunger to learn attracts top educators

With his first spoken word being "car," it might have been inevitable that Michael McConnell would wind up working in the automotive industry. And with his penchant to stay on top of technical training, it also might have been inevitable that he would sign up for Automechanika Chicago, a trade show created by Messe Frankfurt and Advanstar Communications, Inc. (publishers of *Motor Age* and *ABRN*) to address the pressing need for ongoing technical training in the auto repair/collision industries that have changed more in the last 10 years than in their entire history.

The need to attend Automechanika Chicago, which will be held April 24-26 at McCormick Place West, is underscored by the level of sophistication, expertise and experience of McConnell and many other highly educated and experienced trainers who will be in attendance.

McConnell, a service technical trainer, will represent Fremont, Calif.-based Tesla Motors, which is recognized as one of the world's leading electric vehicle manufacturers. Although Tesla's training, offered through the Tesla Academy, covers some of the most sophisticated automotive systems available, McConnell has signed up for six sessions (out of the 116) that he deems crucial to furthering his automotive education: Team-Based Learning Flipping the Classroom; Mastering Voltage Drop;

### BREAKING NEWS EVENTS

## GETTING MORE OUT OF AUTOMECHANIKA CHICAGO

Automechanika Chicago is making its U.S. debut in April, but aside from top training and exhibitors, there are other reasons to take time away from your shop and make it a long weekend in the Windy City.

Specific to the event, city and show organizers have made it easy to get to and from partner hotels and McCormick Place West.

"Many years ago we opened dedicated bus lines. In addition to the surface streets for buses and cars coming into the building, we have an incredible bus lane that is an express bus lane that runs basically parallel to the trains coming in from the city through a dedicated tunnel that's only open when conventions are in town to make the drive from the downtown hotels

**[Go To AMC]** CONTINUES / PAGE 6  
Discussion is on-going in  
[MotorAge.com](http://MotorAge.com) forums

**[Educators]** CONTINUES / PAGE 6

Photo: Messe Frankfurt

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**[Educators]**

CONTINUED FROM PAGE 4

Mastering CAN Bus Failures; Hybrid Vehicle Isolation and Interlock Faults; and Electrical Quick Diagnosis Repairs. (For a complete list of courses available, go to [MotorAge.com/AMCregistration](http://MotorAge.com/AMCregistration).)

McConnell knows the value of an event that brings others like him together. “My main reason for attending Automechanika Chicago is that I love to learn. I am hoping to make some new contacts in the industry while attending this show.... I want to learn from them while attending this event.”

With 15 years’ teaching experience under his belt, ASE certification and a Bachelor of Science in Industrial Technology Education from Purdue University, McConnell should be able to reciprocate with his peers. He brings the experience of helping train 600 technicians located around the globe. The technicians are from most of the OEMs and have various skill levels, so McConnell needs to be well versed across the training spectrum.

Louie Longhi’s plan is to “get to Automechanika Chicago early to visit with vendors and go to classes.” Longhi, program director and lead instructor for Mechanics’ Local 701 Education & Training Program in Carol Stream, Ill., emphasizes, “I expect to learn updated

information and techniques that I can bring back to my classroom to help my students be better prepared for their career.”

ASE certified (Master and L-1) for 25 years, Longhi adds that if he has any extra time at the show, he’ll spend it with the vendors, because “having access to them all in one place is a luxury.”

In making his decision to attend Automechanika Chicago, the fact that show organizers covered the cost of training for 2,000 attendees was key for Matt Beukema, automotive technology instructor for Osseo Senior High School in Osseo, Minn. “The sessions look very informative and worthwhile, but the scholarship sealed the deal for me. In fact, I would not have been able to convince my district supervisor to allow me to go without the scholarship offer.”

Beukema epitomizes what an automotive instructor should be. He is ASE certified and has earned a Bachelor of Science in Technology Education and a master’s degree in Teaching and Learning while working in a shop for 21 years. Moreover, he has 12 years’ experience in the automotive classroom.

With this background, it’s not surprising to learn he already is making plans for the next Automechanika Chicago in 2017 because of the quality and diverse technical sessions, the expert instructors and the range and quality of vendors who will be exhibiting.

“In the future, I would love to bring students to this environment to help them understand that they will never be done learning and that this is a continually evolving career.”

According to Beukema, many of his students seek further schooling even after landing jobs at local shops and dealerships. He adds, “They make good money.” Apparently, that resonates with Osseo’s student population, because there are more than 140 students in the automotive program and more than that waiting to get into the program.

Another highly qualified educator who is attending for many reasons but highlights “the great line up of talented instructors” and the “wonderful venue” as his top two is Mark Larsen, training manager at CarX Tire & Auto Training, Sycamore, Ill. To the former point, Larsen, who has been an automotive instructor for 25 years and an ASE Master Tech and L-1 for more than 30 years, says, “You can never go wrong with Vince Fischelli, Bernie Thompson, and of course, hybrid and GDI courses.”

And you can’t go wrong attending Automechanika Chicago where educators such as Larsen, who also is a former GM technician, college instructor, major brake trainer and U.S. Army instructor, will be in attendance to learn and share a wealth of experience.

— *Larry Silvey,*  
*publisher of custom content*

**[Go To AMC]**

CONTINUED FROM PAGE 4

to the campus within five to seven minutes,” Don Welsh, president and CEO of Choose Chicago, said in a video interview with UBM-Advanstar.

The loop will pick up attendees at partner hotels (see the list at [MotorAge.com/AMC hotels](http://MotorAge.com/AMC hotels)), and there will be transportation from the hotels to Navy Pier for an opening night party April 24 from 5 to 7 p.m. The free event is open to attendees and exhibitors, and includes drinks, appetizers and entertainment.

Navy Pier also is one of several attractions Choose Chicago representatives highlight as places not to miss after show hours or for your families coming along for the weekend. Darrell Baker, Choose Chicago’s vice president sales,

trade shows, pointed out lists of attractions, including the free Millennium Park, Lincoln Park Zoo and Cloud Gate (the “Bean” where many people snap pictures), as well as Lurie Garden, the Skydeck Chicago in the Willis Tower, Lookingglass Theatres, Broadway in Chicago, Shedd Aquarium and Chicago White Sox, among many others. (Sorry, Cubs fans, they’re on the road then.)

For those driving, there are public transportation options, from L Trains, buses and taxis to the-speed Metra commuter rail train connects suburbs to downtown. ChooseChicago.com has links to places where you can park and lots where you can pay ahead of time.

In addition to entertainment and attractions, there are more places to eat each evening than can be listed, all fitting various price ranges. “We have over 3,000 restaurants and taverns and

bars and entertainment facilities in the downtown core,” Welsh says. “You’re going to find a very, very dense, walkable downtown. Great shopping, great restaurants, great attractions, if people have time to take to the city in addition to being here for business purposes.”

Back on the business side of things, putting a plan on paper is important to making the event a success, according to Brian Canning, a *Motor Age* contributor who has written about attending industry events. He suggests writing out what you want to accomplish at the event, making that plan when registering and sticking to it once in Chicago.

You also can take advantage of the event to talk to owners and techs just like you from around the country and see what they are doing in their shop and how they are solving problems.

— *Tschanen Brandyberry, managing editor*





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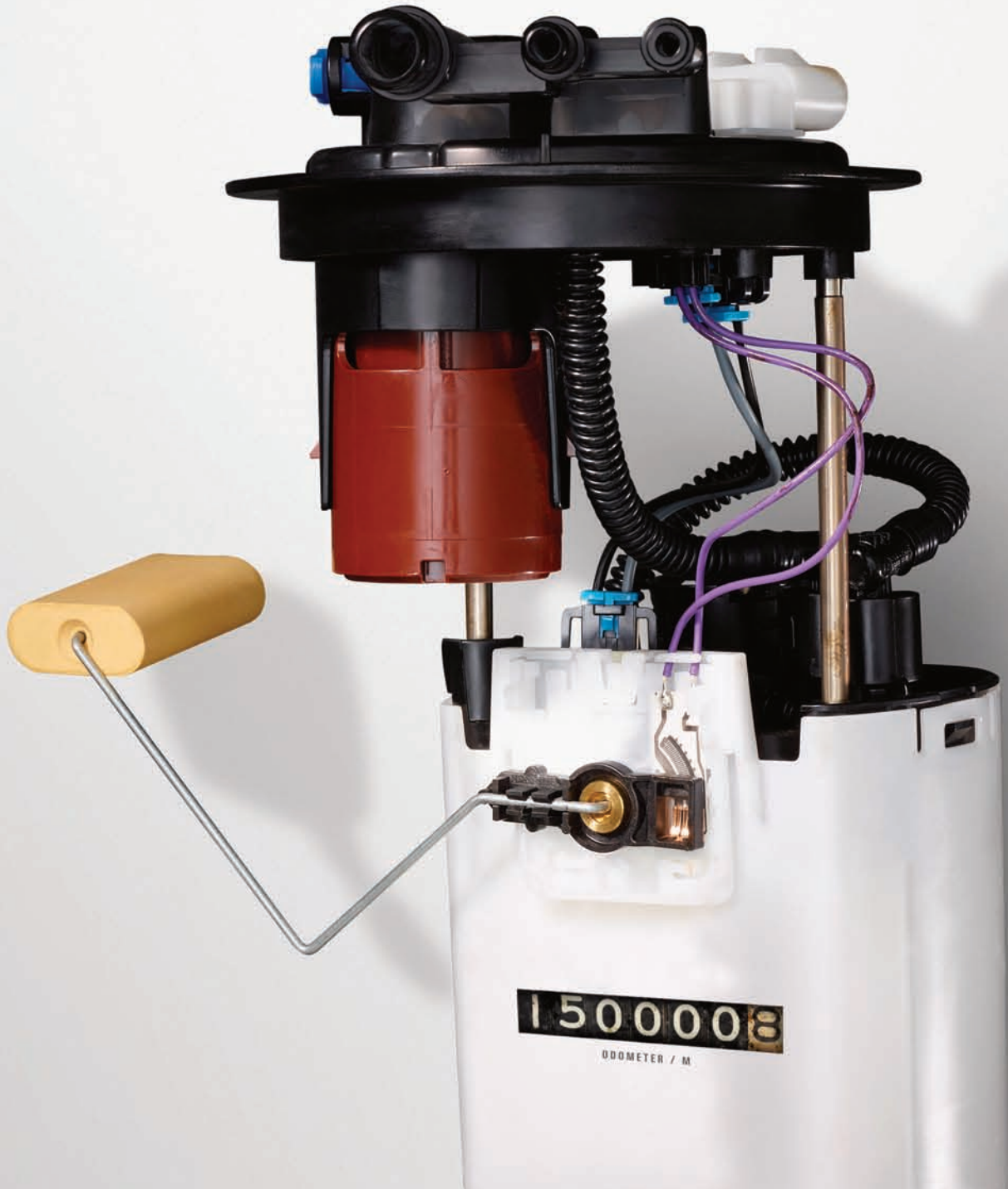
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# A MOBILE PASSION FOR FIXING CARS

BY PETE MEIER | TECHNICAL EDITOR

Nearly every technician who has taken the plunge into the mobile diagnostics business shares common attributes. One, of course, is their desire to work for themselves. Another is a passion for fixing cars right the first time, every time, and their success is dependent on that skill. After all, that's what they are called in to do – fix the problem no one else in the shop has had success with.

But what might surprise you is that most report that the majority of the problems they are paid handsomely to pinpoint (most do not actually make the repair, they just direct the client as to what repair to make) could have been solved without their help had the tech(s) followed a logical process, spent some time investing in their own educa-

tion and avoided the temptation of relying on “silver bullet” fixes.

Mobile diagnostic technicians comprise a portion of attendees signed up for Automechanika Chicago.

Jamey Quincel of JCJ Mobile Diagnostics in Canal Winchester, Ohio, shared his thoughts on training. “I spend three weeks a year going out of state for training. I've been to all the local training, but in my opinion it always seems to be the same stuff. If there is a class I think I need to stay current, I don't mind traveling to get it.”

John Anello, owner of Auto Tech On Wheels in Montclair, N.J., and one of the first techs to take his diagnostic skills on the road says, “We're the guys who are constantly learning. We're the guys investing in the equipment.” He goes on to explain that most of the shops he's called in to help often have the resources they need to fix the problems themselves, they just don't use them or know how to use them.

“I try to educate the shops while I'm there ... to make their lives a little easier. It helps me form a relationship with

that garage.”

Michael Burmester of Advanced Mobile Diagnostics in Holbrook, N.Y., and a newcomer to the world of mobile diagnostics echoes Anello's view. “Most of the time I let the shop techs follow along with me. What might take them a few days to find, I might find in 15 minutes. And it's not me, necessarily, but that I've taken the time to understand the system and how it's supposed to work.”

These men are driven by the satisfaction they get from a successful diagnosis. And all will tell you the same thing. It's not that they are smarter, more experienced or a better tech than their peers. They have pride in what they do, and a desire to reason out a problem. And that drives their commitment to training and continuing education.

Ed Hazzard, owner of Automotive Tech Systems in Newburgh, N.Y., adds, “(Training) is one of those tools that nobody can take away and you can use it anywhere. It helps you become more proficient and a better tech, and if you're a better tech you'll make more money.”

## Automechanika Chicago offers a true international flair

Known as “The City of Big Shoulders” for its can-do attitude and rugged industrial might, Chicago has long relished its role as a global melting pot overflowing with opportunity. At one time 28 carmakers were producing completed vehicles, and the very concept of the “car show” made its debut here in conjunction with the first American auto race held in 1895.

Thus it is only fitting that the city hosts the inaugural Automechanika Chicago taking place April 24-26 at McCormick Place West. The list of nations with a presence at Automechanika Chicago is impressive, including (as of press time) Bulgaria, Canada, China, the Czech Republic, Denmark, Germany, Hong Kong, India, Italy, Korea, Lithuania, Malaysia, Mexico, Poland, Singapore, Spain, Taiwan, Turkey, the United Arab Emirates, the UK and the U.S.

Accenting the global flair of the industry event will be a series of international pavilions. “Since Chicago is a

truly international destination easily accessible from across the USA, UK exhibitors are certain to benefit from having presence at this U.S. show,” says Chloe Hyland, spokeswoman for the United Kingdom's Pavilion.

“Chicago is home to over 160,000 individual shops, of which 23 percent are within 500 miles of the exhibition center,” she reports. “These open doors offer UK exhibitors opportunity to build relations with these international suppliers and retailers and increase their exports exponentially.”

The Society of Motor Manufacturers and Traders (SMMT), is presenting the UK Pavilion with Messe Frankfurt, says Hyland. “The SMMT UK pavilion will have a prime location at the front of the exhibition hall, where a number of UK companies will take exhibition space. Visitors can expect to see Top Gear, BG Automotive, Presco Radiator Caps and Autokontrol, amongst others.”

Italy is Europe's fourth-largest supplier of auto parts with more than \$545 million in annual sales. At least eight Italian companies will be displaying their latest products and cutting-edge technologies in the categories of Parts

& Components, Accessories & Tuning, and Repair & Maintenance.

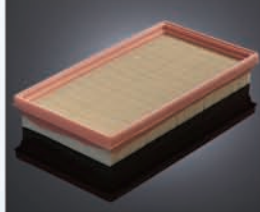
In particular, the Italian Pavilion “will offer business opportunities and an array of innovative products thanks to the participation of four Italian exhibitors,” the producers point out, adding that “potential business is relevant and Italian companies are strongly attracted by opportunities offered by this market. Automechanika Chicago represents for them a reliable and qualified event, renown all over the world for its capilarity, internationality and strong orientation to a professional audience.”

Global networking opportunities also are a draw. Professor Al Playter, coordinator of the Automotive and Motorcycle Programs at Centennial College's School of Transportation in Toronto, Canada. He'll be leading a team consisting of several automotive-related professors. “I have to be teaching cutting-edge, because if I'm not the students will know it,” he explains. Canadian technicians undergo a governmental licensing process that entails attending classes at Centennial while also serving an apprenticeship at an industry business.

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## ASE GUIDES

### QUESTION OF THE MONTH



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☑ **SURVEY:** Tech A says a hybrid air conditioning system using an HV electric compressor can be serviced with the same Recovery/Recycling/Recharge machine as conventional systems. Tech B says even a small amount of PAG oil introduced into this system could result in HV isolation fault codes being generated that may require replacement of every component in the system. Who is correct?

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

Log onto [MotorAge.com/mar15survey](http://MotorAge.com/mar15survey) to answer and register for our monthly contest from Federated Auto Parts.



## Three quick video marketing tips

Getting started with video can attract new customers, including younger ones.

BY GARY MCCOY | WORKSHOP MEMBER

Having a video on the website for your repair shop may not be top of mind in your marketing toolkit. But it should be. A short, well done video that introduces customers to your business can be effective way to drive traffic into your shop, especially among millennial customers who often prefer video over print.

"There are loads of marketing videos on the web now, and some extremely effective," says Jennifer Santoro, integrative marketing specialist and the so-called "chief happiness officer" for InVidz Smart Video

Technology. "But there are plenty that just don't work."

Here's are three things Santoro says you should avoid:

1) The video takes too long to get to the point. Santoro says the attention span for video watching seems to be about 60 seconds. "...Viewers don't want to hear a marketing message that goes on and on."

2) The video content is inauthentic. Santoro says never try to portray yourself or your company as something you're not. "Embrace who you are and what you actually offer; people will relate to and engage with that content."

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

### G. Jerry Truglia / New York

#### TST's 12th Annual Big Event

Technicians Service Training presents The Twelfth Annual TST Tech Training Big Event, featuring Carlong Banks, John Anello, Dave DeCoursey and Pete Meier.

The event is Saturday, March 21, from 8 a.m. to 5 p.m. (check-in starts at 7:15 a.m.) and includes two manuals, food and a tool raffle. It is at the Ramada Conference Center, 542 Route 9, Fishkill, N.Y. The cost is \$260 for TST members, \$335 for non-members. Visit [www.TSTseminars.org](http://www.TSTseminars.org) to sign up. Here are some course details.

- Networks — Communication Protocols: Those dreaded "U" (No Communication) Diagnostic Trouble Codes! The causes are many, the solutions hard to find. But they need not be! This seminar will take a look at GM, Ford and Chrysler communications

techniques involving lab scope analysis that will be used to enhance the understanding of these networks. A series of case studies will be reviewed as well. This presentation also takes a look at the GM MOST protocol on newer GM products, so don't you be afraid of the "U" any more.

- Auto Diagnostic Science: This seminar will focus on top case studies Anello has collected in the field. The case studies will cover different systems of the vehicle along with the different types of problems. These case studies were selected from vehicles diagnosed in order to provide the technician valuable diagnostic information and procedures.

With the introduction of as many as 60-plus controllers on today's vehicles, it is important to provide technicians a wide spectrum of problems and solutions. This seminar will demonstrate procedures on vehicles

to help you better understand that a good diagnostic game plan can be applied to each and every system by simply knowing and understanding the foundation of on-board computers. Each case study will provide a strategy to resolve each issue and will be coupled with theory of operation.

This is not a tips and tricks seminar but more of a look at how Anello got to the answer that resolved the problem. Anello will focus on ways to utilize different types of equipment in your shop to test and probe vehicles as well as introduce newer test equipment that may help you better expedite the diagnostic process. If you eat, drink and sleep diagnostics or just want to be a better diagnostic technician, then this is a seminar for you.

MARCH 26<sup>TH</sup> 2015  
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PETE MEIER

*That nagging TPMS light*

3) Distracting noises on the audio. As a rule of thumb, Santoro says the visual can be substandard but the audio can't. "Visually you don't have to do anything fancy. A simple shot of you speaking in front of a nice

background will never be distracting. However, distracting noises in the audio will kill your video every time." For repair shops, you can shoot a video in your bay or in your lobby. For more, go to [MotorAge.com/videotips](http://MotorAge.com/videotips). **ZZ**

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APRIL 24 8:30-11:45 A.M.

**Top 10 DTCs**

Presented by Ken Zanders.

APRIL 24 8:30-11:45 A.M.

**Asian Drivability**

Presented by John Thornton.

APRIL 24, 2:00-5:15 P.M.

**The Numbers Don't Lie - Tracking Internet Marketing**

Presented by Danny Sanchez, sponsored by AutoShop Solutions.

APRIL 24, 2:00-3:30 P.M.

**The Medium Duty Truck Workshop**

Presented by Peter Luban, sponsored by TransTec by Corteco.

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CHICAGO APRIL 24 TRAINING

APRIL 25 8:30-11:45 A.M.

**Mastering Voltage Drop**

Presented by Jaime Lazarus.

APRIL 25 8:30-11:45 A.M.

**Inside Honda IMA**

Presented by Dave Macholz.

APRIL 25 2:00-5:15 P.M.

**Leveraging Your PC for the Automotive Service Professional**

Presented by Scott Brown, sponsored by the International Automotive Technicians Network (IATN).

APRIL 25 2:00-5:15 P.M.

**Advanced Techniques for Diagnosing EVAP Problems**

Presented by Bernie Thompson.

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CHICAGO APRIL 25 TRAINING

APRIL 26, 8:30-11:45 A.M.

**The New 300,000 mile / 500,000 km Service Strategy**

Presented by Kevin McCartney, sponsored by NAPA Autotech.

APRIL 26, 8:30-11:45 A.M.

**Advanced Drivability and Performance Diagnostics**

Presented by Ron Bilyeu (ATG), sponsored by ANSED Diagnostic Solutions.

APRIL 26, 8:30-11:45 A.M.

**Bosch Direct Injection Technology Update**

Presented by Bob Pattengale, sponsored by Bosch Automotive Service Solutions.

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**A majority of owners...**

A majority of shop owners in the auto repair industry find taking the shop to the next level is their main problem.

[MotorAge.com/owners](http://MotorAge.com/owners)

**Timing your videos**

This month, Dave Striegel looks at what you should focus on in your videos and how long they should be.

[MotorAge.com/videomarketing](http://MotorAge.com/videomarketing)

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*Noteworthy*

comments from MotorAge's online communities

The best of what you're saying on [Facebook.com/MotorAgeMagazine](https://www.facebook.com/MotorAgeMagazine), [@Motor\\_Age](https://twitter.com/Motor_Age) and in the Motor Age Magazine group on LinkedIn.

Jay Douglas via LinkedIn:

It's pretty straight forward. I treat every vehicle as if I owned it. I show the customer what I do to my own vehicles. They then see that I'm not selling them a bunch of "fluff."

Christian Byler via LinkedIn:

When using the manufacturer's intervals and/or owner's manual consider this. ... In the very competitive new car market, they have to do whatever they can to get an edge. One such way is to say that they have the best (read lowest) maintenance cost. How do they do that?

By extending intervals and decreasing the number of recommended services.

Rick Zirbes via LinkedIn:

Knowing what you are looking at, meaning components, circuits and connections, and understanding the impact of each piece helps you get closer to the correct fix for the problem. In today's world if you can't understand this part, you will have a tough time completing many or most repairs.

Raymond Massenberg via LinkedIn

One of the benefits of battery-electric cars is that

they have far fewer moving parts than gasoline vehicles, so they require less servicing. Or as the old saying goes, "Nothing but tires and wiper blades" — which is a bit reductive.

Nancy Patton Bishop via LinkedIn

Have a few questions about ASE Study Guides? Chances are that we have the answers you've been looking for! Check on here for the most frequently asked questions and answers!

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## OPERATIONS

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## IN THIS SECTION

- 14** Management
- 20** Profit Matters
- 24** Financial Figures
- 26** Shop Profile

read it on **MotorAge.com**

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## MARKETING VIDEOS

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## MANAGEMENT

# YOUNG TECHNICIANS AS AN ENDANGERED SPECIES

THIS ISN'T YOUR DADDY'S GROUP OF NEW TECHS (AHEM, YOU). YOU NEED TO TREAT THEM AS SUCH.

BY **BRIAN CANNING** | CONTRIBUTOR

**THERE** is a growing shortage of younger technicians who want to get into automotive repair as a career. According to the Manpower Group, "Hardest to Fill Survey for 2013," automotive mechanics (technicians) are among the hardest positions to fill in the U.S. Going back to 2008, they are frequent and prominent in this list of dubious distinction.

The reasons for this are complicated, both the result of attrition, a growing economy that is driving consumer demand and a trend that is seeing fewer and fewer young people choosing automotive repair as a career path. While a great many of the most experienced and knowledgeable technicians are retiring or moving on to opportunities in other industries (a concern in and of itself), the number of young people choosing automotive repair as a career is not adequate to meet the current or future needs and poses tangible risk to the automotive repair industry.

Generation Y, otherwise known as the millennial generation, refers to individuals born between 1982 and 2005.

Rather than waiting for them to blindly follow us, which probably won't happen, we need to find ways to effectively engage them and lead them, and in this, understand what makes them tick. Millennials have been praised and rewarded for creativity, innovation and thinking outside the box, are comfortable with and even look forward to change, were raised to be assertive and are not afraid to ask questions, and they want answers. Older generations encouraged millennials to stand up for themselves. Millennials strongly believe in working smarter not harder. They are always looking for shortcuts and simplified ways to do things; not because they are lazy, but because they want to be more efficient.

### Pairing up for Progress

An important consideration in all of this is how your existing staff will react to you bringing on a young technician and how they will treat him or her when you aren't around. By its very nature, being a technician in an automotive repair shop is competitive, and if you are not careful that fresh faced young



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Source: Independent laboratory nail climb test against 2014 low VOC PB Blaster Penetrating Catalyst Product. WD-40 Specialist Rust Release Penetrant Spray with Blu Torch Technology travels up a nail 2x faster than the competitor. August 2014.



millennial will get a very unfriendly reception and be exposed to a side of the business he would rather not see.

I suggest you assign a senior technician as a mentor for any young technician we would bring on and provide him with incentives toward the success of his charge. You need to make these arrangements finite and closed ended (12 to 24 months) because we are not looking for a permanent arrangement and want results sooner rather than later but giving that seasoned tech great reasons to invest his time and effort in an aspiring young tech will pay huge dividends down the road. A basic example is an 18-month plan that would pay a portion of the young technician's billed hours to the senior tech, with bonuses for ASE certifications and exceeding production goals. It all needs to be paid for out of generated sales, but the advantages to this approach are many.

For it to work, it needs to be a win for the senior technician, the junior technician and especially for the business. Under ideal circumstances, the senior tech would be training his replacement,

with the junior tech benefiting from the years of knowledge and experience of his assigned mentor. Rather than facing a hostile adversary, our young millennial would have a motivated and interested mentor (bonuses assure the right motivation) to set him up for a long and successful career. Everyone wins.

There is no doubt that it takes the right mentor to make this work as well as some forethought and planning. Bringing your senior tech in on your intentions early is critical, and he or she has to have a win on the other side. If the thought is you will use your seasoned technician to train his replacement when the senior has no plans of moving on, you are setting yourself up for civil war and the young tech up for failure.

By the same token there has to be a value in it for the young tech and a viable career path. If we assign a senior tech who is reluctant to pass on any of the knowledge he has gained over the years and who looks on the young technician as a gopher or errand boy, you can rest assured that the young tech either will move on or never achieve the

great career he had anticipated. You, as a shop owner or service manager, have to guard against this. If this is going to work, and it is to everyone's advantage if it does, leadership and oversight are very important parts of any plan you would come up with. The senior tech benefits financially for his time, effort, knowledge and experience. The young up and coming technician gets a mentor and benefits from those years and years of experience. The shop assures its core competence and viability into the distant future. *TM*



**BRIAN  
CANNING**  
CONTRIBUTOR

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

Email Brian at [brimarc@hotmail.com](mailto:brimarc@hotmail.com)

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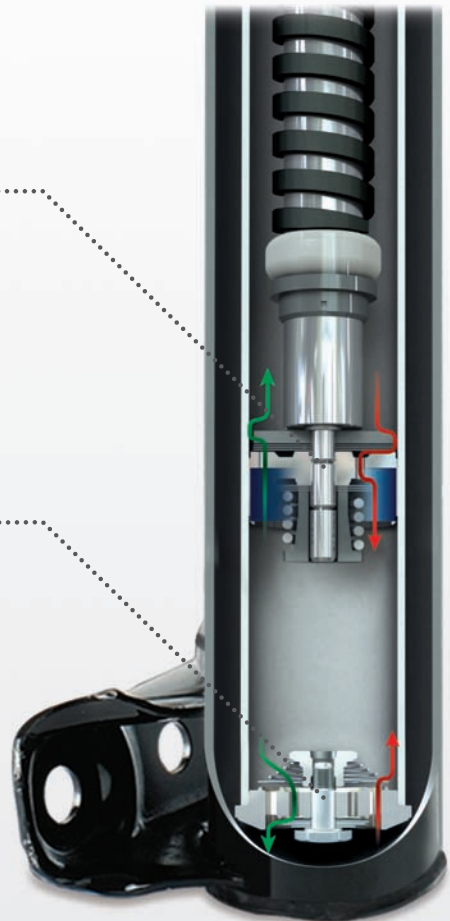
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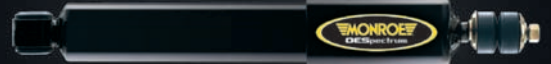
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# WHAT AN EASTER EGG HUNT CAN TEACH

LESSONS LEARNED AS A CHILD IN THE YARD APPLY TO HOW YOU WORK WITH EMPLOYEES.

BY CHRIS “CHUBBY” FREDERICK | CONTRIBUTOR

**WHEN** you have been working with shop owners and their businesses for more than 40 years, you see lots of change. The one change I hate to see is when a shop that was admired by everyone in the area slips into half as good as what it once was. It typically happens gradually, with the owner blaming everything including the bathroom sink. The reality is most owners are working so hard in the business they actually don't know what is happening to them. I was listening to a rather long but worthwhile story from Kim Hickey, an ATI coach and former shop owner, explaining how it can happen to anyone.

Kim began by asking if you ever have been sitting somewhere enjoying doing nothing when you overhear someone say something so ridiculous it just makes you almost jump out of your skin? And try as you might, you just can't keep your mouth shut about it? That's how she moved into this story.

The other day I overheard a group of women chatting about Easter: who was coming for dinner, what kind of pies, blah blah blah. It was then that I heard something that made every part of me nuts. A few of the women were speaking about the Easter egg hunts they were planning and where they were going to hide eggs, candy, etc., when one woman started to reprimand them.

She said they could not just randomly hide candy, eggs and prizes because if they did, there would be no way for them to ensure every child received the same number of eggs, the same amount of candy and the same amount of prizes. She continued to speak and say that if all the children did not all get the same kind and amount of loot that it could lead to hurt feelings and possibly cause a child to grow up insecure.

She had a plan that would spare the world from these children who could be permanently and psychologically damaged by getting shorted at an Easter egg hunt. Her plan was to color code each egg and basket. Each child would be assigned a color and they would be





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CHRIS “CHUBBY” FREDERICK [ATI CEO]

permitted to hunt only for the eggs of that color. Each set of colored eggs had the same number of eggs and the same prizes and money in them. The story reminded me why it is so difficult to find employees that want to work — they want to get paid, applauded and praised just for showing up.

### A Level Playing Field?

While her intentions might have been good, her plan was not. Her plan stripped and robbed participants of being victorious. It robbed them from being rewarded for excelling. It robbed them of learning that if you plan better, work smarter and try harder, you will be rewarded. Is it any wonder with plans like these that so many people lack problem-solving skills, competitiveness and the drive to improve themselves? It is because of well-intentioned ideas like these that people are just about encouraged not to work hard for anything, and instead expect and demand that it will just be given to you.

If there were any long-term damages incurred as a result of a child participating in this Easter egg hunt, the damage would not be insecurity, it would be lack of motivation. To that woman, it is just an Easter egg hunt. In reality, it is a learning opportunity. It is a thinking game. It is a venue to learn how to strategize and outsmart your opponents. It forces you to figure out how you can stay two steps ahead of everyone else. It is a lesson in planning.

I still can remember going to bed the night before my childhood Easter egg hunts and laying out my plan of attack. I would mentally check off all my cousins' strengths and weaknesses. As I lay in bed too excited to sleep, I would picture the layout of the yard and decide where I would start. I learned very quickly that you don't start at the first cluster of eggs where everyone else was. If I did that, not only would I be outnumbered, but I could possibly get trampled because I was smaller.

I also learned quickly that being



greedy is not good either. If you ran for the giant chocolate or stuffed Easter bunny, you wouldn't have room or hands to carry anything else, so while the big kids were each grabbing a huge stuffed or chocolate bunny, I was grabbing lots of eggs and smaller things. Some even had money in them.

I could not be more delighted with how shortsighted my cousins were. They always went for the path of least resistance. Because my cousins were bigger and stronger, I had to use my head and learn to weigh my options. Had someone just said here is a yellow basket, go fill it with the yellow eggs, I would not have had to do or learn anything. Instead I would be waiting for my handout.

As my cousins watched me each year, they got smarter. They started to spend time coming up with a better plan. They began sizing me up and looking for my weaknesses. I had to make adjustments to my strategy every year. If I didn't, I would not have been able to continue to be victorious. I had to evolve, be aware of all my opponents' strengths and weaknesses.

### Set the Bar High Enough

You should use the same skills you used as a child hunting for eggs in running your business. When you are putting together pay plans and reward programs for your employees, are you creating ones that encourage them to work smarter, try harder and continue their education? What are you doing to set the bar for them? How are you helping to motivate them to become better versions of themselves?

What about you? Are you aware of your competition? Have you taken inventory of your strengths and weak-

nesses? Are you evolving? Have you been staying current with the latest technology and keeping abreast of what is new in our industry?

How much research have you done on learning about future trends in your field? Do you ever take a walk around the neighborhood your shop is in and randomly stop in stores and ask where the best automotive repair is and see what answers you get? How often do you pull up at your shop and peruse the parking lot, walk through the front door, sit in your waiting room, stand at your counter? When was the last time you looked honestly at your shop like a customer does?

### Get Back in the Game

If you answered no or I don't know to any of the above questions, you could be in danger of being left behind without even realizing it. In today's world, maybe at schools and during Easter egg hunts you can get away with doing the minimum and still get a reward, but in the business world that doesn't happen.

Do you want to test your strengths and weaknesses against your competition? We have a diagnostic worksheet you can use to assess if you are staying the best shop in your market. For a limited time, you can find it at [www.ationlinetraining.com/2015-03](http://www.ationlinetraining.com/2015-03).



Chris "Chubby" Frederick is the CEO and founder of the Automotive Training Institute. ATI's 108 associates train and coach more than 1,150 shop owners every week across North America to drive profits and dreams home to their families. Our associates love helping shop owners who 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 and former shop owner Kim Hickey.

E-mail Chubby at [cfrederick@autotraining.net](mailto:cfrederick@autotraining.net)





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# A GREAT RECIPE FOR A PROACTIVE, POSITIVE AND CONSTRUCTIVE REPAIR INDUSTRY

DECIDE WHO YOU'RE IN BUSINESS TO SERVE AND YOU WILL COOK UP A SUCCESSFUL PLAN FOR YOUR BUSINESS.

BY **BOB GREENWOOD**  
CONTRIBUTOR

**SHOP** owners across the U.S. are realizing the competitive world of the automotive repair industry is heating up like never before. The new car dealerships are becoming increasingly focused on taking the independent repair sector's business away and keeping it.

Based on what I see, however, I don't think the new car dealership strategy ultimately will work because:

- New car dealers run their business focussed on cost, which means they view, for example, all technicians as a cost to their business. Consider that competent employees make a business money; they create a great return on investment for the business. Dealerships, however, control costs by paying flat rate to technicians without regard to building long-term career orientated business/personal relationships with their technical team.

History has proven the lack of respect for technicians is strong at the dealer-

ship management level. Many independent shop owners have confirmed this, as many have come from working in a dealership environment. Due to the shortage of competent technicians, dealerships are starting to guarantee a set amount of hours per week to their technicians. However, to control costs, they have fewer of them in the bays. We know of many examples where a dealership with 10 to 15 bays will have only two or three licensed technicians and the balance of staff are basically support staff or helpers.

This lack of knowledge will backfire over time, as quality control of services being performed consumer becomes an issue. Lack of quality work and service works against the consumer.

- New car dealerships do not have enough bays to service the total current fleet on the road, which means a definite further inconvenience to the consumer, as scheduling service appointments increase in the waiting time. They also

don't have as many dealerships locations, therefore the consumer is going to have to drive further for service.

- New car dealerships are trying their utmost to keep vehicle technology information away from the independent sector. The next battleground will be telematics information and its ownership. As the public becomes more informed about this issue, the backlash against dealerships could be very strong. The consumer owns their vehicle information, not the manufacturer. The consumer has a right to choose where their information goes. Monopoly style concepts within the capitalist system do not work in favour of the consumer.

- New car dealerships go out of their way to imply innuendoes to the consumer that their warranty will be void if services are not performed at the dealership and with OE parts. Innuendoes are implied to the consumer but they legally cannot put those statements clearly in writing to the consumer.

### Looking at the Dealerships

Now I know of some excellent new car dealerships across the country that work well with certain independent shops. However, they are in a small minority. Too many dealerships will just sell parts to the independents, creating additional dealership profits for themselves, but they do not respect the independent as can be confirmed by the above mentioned issues. The best dealerships desire a full professional relationship with the select independents because they do recognize and respect the independent business in understanding the best independent works on all makes and models, requires more training which produces a more in-depth of quality staff and more equipment is required in their location to meet and service the consumer's needs.

These issues create opportunity for the entire automotive industry. Consider the objective is to have a bottom-line profitable business with a satisfied consumer enjoying, as much as possible, their experience with the servicing of their vehicle.

Consider there are many excellent independent shops across the country. The great shops are focussed on service and quality to their client base. These shop owners understand professional business relationships and the importance of a win/win business relationship to the success of each parties business.

Consider these above average independent shops now judge the type of relationship they have with local dealerships in terms of help and support on technical issues. They now actually advise their clientele on which type of new vehicle to purchase based on the quality of the vehicle and if the dealership will work with the independent to serve that particular client's needs.

Consider the power of this business relationship when fully executed in a professional manner. Consider the best independents are as good as anybody else, but to have an equal chance of working with a new car dealership they have to do much better than the average dealership. The saddest thing I have seen over my career within this industry with competitive businesses,

is to see a business competing because he or she is required to compete, not because they have a desire to compete.

When someone is required to compete, his or her main focus is only on price. When someone has a desire to compete, he or she focuses on a standard of how to do something with a great deal of value-added. This elevated standard enhances bottom-line profitability. This would be great for our entire industry to embrace. **ZZ**



**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 AAM approved instructors.

✉ E-mail Bob at [greenwood@aaec.ca](mailto:greenwood@aaec.ca)

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## OPERATIONS

## SHOP PROFILE

A snapshot of one of the industry's leading shops

REVOLUTION / DECATUR, GA.



# How the garden grows

A literal and figurative garden offers Revolution, a Georgia shop, organic ways to reach customers.

BY **ROBERT BRAVENDER** | CONTRIBUTOR

For at least four generations, members of Matt Purselle's family have been entrepreneurs in various endeavors, from manufacturing to retail. So it was only natural that Purselle bought a struggling three-bay import repair shop in Decatur, Ga., and turned it into one of the area's leading Mercedes-Benz facilities.

"While attending Georgia Tech as a mechanical engineering major looking to design cars," Purselle relates, "I made a friend whose father owned the oldest independent Mercedes-Benz repair shop in Atlanta. After my junior year, I took a summer job working for him, fell in love with the Mercedes-Benz marquee and never returned to engineering school."

It was 1999 when he bought Classic Repairs; only five years later he had to purchase and renovate a five-bay shop a mile down the road because he had outgrown the locale. In the process he changed the shop's name to Revolution. "Moving into a nice new facility, it was time to change in a lot of ways, and the name fits with that," Purselle reports.

Eight years later, they again outgrew the facility. Instead of moving, Purselle opted to expand, adding four more bays, a dedicated parts room, a break room, a detail bay and more employees.

"We also replaced the roof with an energy efficient reflective membrane and added 62 solar panels which create about one-third of our electricity on a summer day," he points out.

Things were progressing for the company, but Purselle signed up with Automotive Training Institute (ATI) because he saw room for improvement in his own management and leadership skills. "I'm good at managing time and figuring out the best ways to do things," he assesses, "but to (motivate) other people to do things my way for the business, that was always hard."

That included building a database from customer inspections. "We've always had a paper filing system," says Purselle. "We converted to save on paper." After scanning in all of their old files, Purselle also created an inspection checklist to counter a problem he had run into as Revolution grew.

## REVOLUTION

**Matt and Kathryn Purselle**

Owners

**Decatur, Ga.**

Location

**1**

Number of locations

**15**

Years in business

**9 / 6**

Total number of employees/techs

**7,700 square feet**

Shop size

**9**

Number of bays

**\$1.6 million**

Annual gross revenue combined

**ATI**

Shop affiliations

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"I was getting different answers on the same car from different technicians," he notes. "We were previously doing it with just service visits; now we use them every time a customer comes in for their first time in or if we haven't seen them in three months."

To standardize responses, he came up with a more thorough inspection form on the company's computer system.

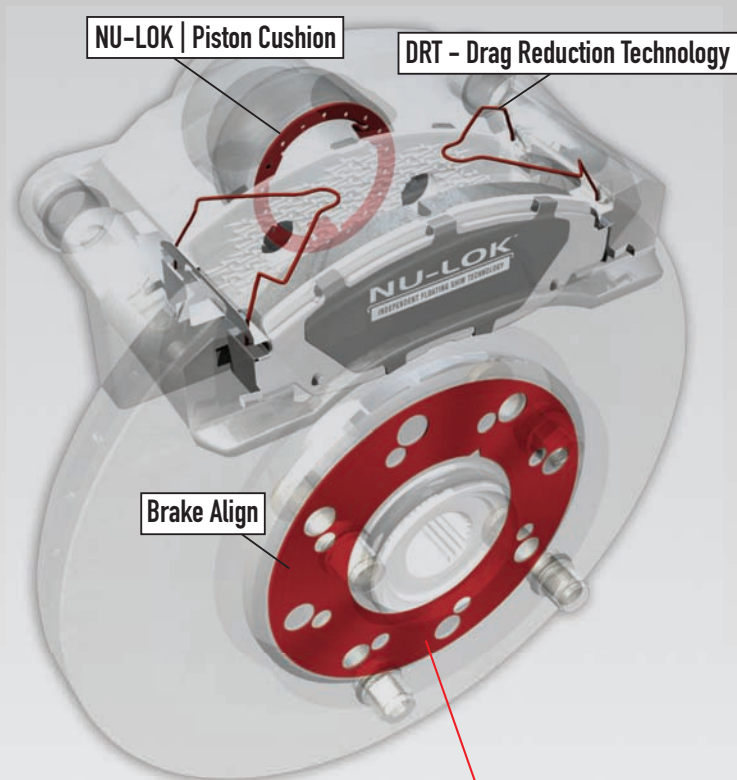
Photos: Revolution



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“It slowed everybody down at first because they have to answer a lot of questions that they didn’t have to before,” he reports. “Where we used to just write down what was wrong, now we can see what’s wrong, what’s right and track them. We might see a transmission front pump leaks, and the next time that customer comes in its dripping; we can see that it’s gotten worse. So when you answer the questions you have your ‘OK’/‘Not OK’ and ‘Holy crap, call the customer!’”

“(Actually) the way we’ve built it, when you say ‘Not OK’ with a lot of stuff, it opens up another question that you have to answer. When you answer those questions it may open up another question. I’d like to find a programmer to get it work the way I really want it to,” comments Purselle, “but I haven’t had the time or energy to do that yet.”

In the meantime, they use this info to build a maintenance schedule for the customer, which gives the latter more

time to visit the most unusual feature of the shop: a “pseudo organic” garden.

“My mom grew up on a farm, my wife’s family owns a farm; we always had a garden in our side yard growing up,” Purselle offers. “We don’t have room at home for one and the shop is on an acre of land, so I have about eight garden beds out front.”

Purselle explains that some of his plant seed came from commercial sources, hence the “pseudo,” but most are heirloom vegetables, and he doesn’t use chemicals or pesticides to enhance them, hence the “organic.”

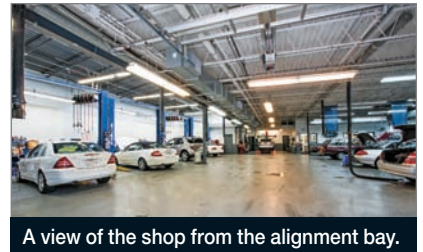
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There are seven gardens onsite in all.



A view of the shop from the alignment bay.

Excess produce is often offered to customers; some even request it. “I did it for myself, but people really do like the garden,” Purselle comments. “It’s kind of an interesting selling point. It creates buzz with customers, a way to connect with people, something to talk about other than their cars when they come in. Most people have never even seen asparagus growing.”



**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](mailto:rbravender@comcast.net)



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**NEW SALES**

LUBEGARD reports the addition of Mark Roach to sales management team  
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# The Seven Sisters

**HOW HAVE SUBARU TRANSMISSIONS CHANGED? IT ALL STARTS WITH A STORY.**

BY **WAYNE COLONNA** | POWERTRAIN PRO PUBLISHER

**OFTEN** I become curious as to the origin of a phrase or a name. This frequently is prompted by the different names I see given to vehicles. On one occasion after a day's work, several of us here at ATSG sat around talking, and I brought up this subject. This provoked a comical story of wit among us using the names of vehicles.

It was something like, "A Grand Caravan made a Voyager to Daytona to enjoy a Sebring, then on to Town and Country including 5th Avenue and Aspen and all the way to the Pacifica.

"They had quite a Vision. Grand Cherokee and Comanche argued with the Commander about using

a Compass as opposed to doing a Valiant Sundance.

"Others just wanted to Cruise using Satellite communication to Charge ahead with Nitro enjoying the Airflow. Some said this was a Cirrus and took the Concorde with pilot LeBaron to Monaco and then Windsor enjoying a Magnum of wine on the way. When the Grand Caravan suffered an Intrepid brake problem with the Caliber, they took the Liberty to go to a Premier show watching a Patriot's wife be bitten by a Viper, to which he Avenger by a heavy Ram to its head. This was quite coincidental, since the two ended the day romantically enjoying the astronomical sign

Aries in the night sky, which is the symbol of the Ram.

"It was an amusing time as we continued the story using names from Ford and GM vehicles. But speaking about astronomical signs in the night sky, you might be surprised to learn that Subaru is the Japanese name for the Pleiades star cluster M45, otherwise referred to as "The Seven Sisters." According to tradition, one of these sisters is invisible. This is why Subaru has a blue oval emblem with six stars in it (Figure 1).

It also is representative of the companies, which merged together to form Fuji Heavy Industries (FHI). FHI is a Japanese multinational corporation and conglomerate involved in aerospace and ground transportation. It is the maker of Subaru automobiles, the subject of this article. This will supplement two previous Subaru articles written in 2013, one called "The many Changes to the Subaru 4EAT" and the other "A Second Glance."



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.

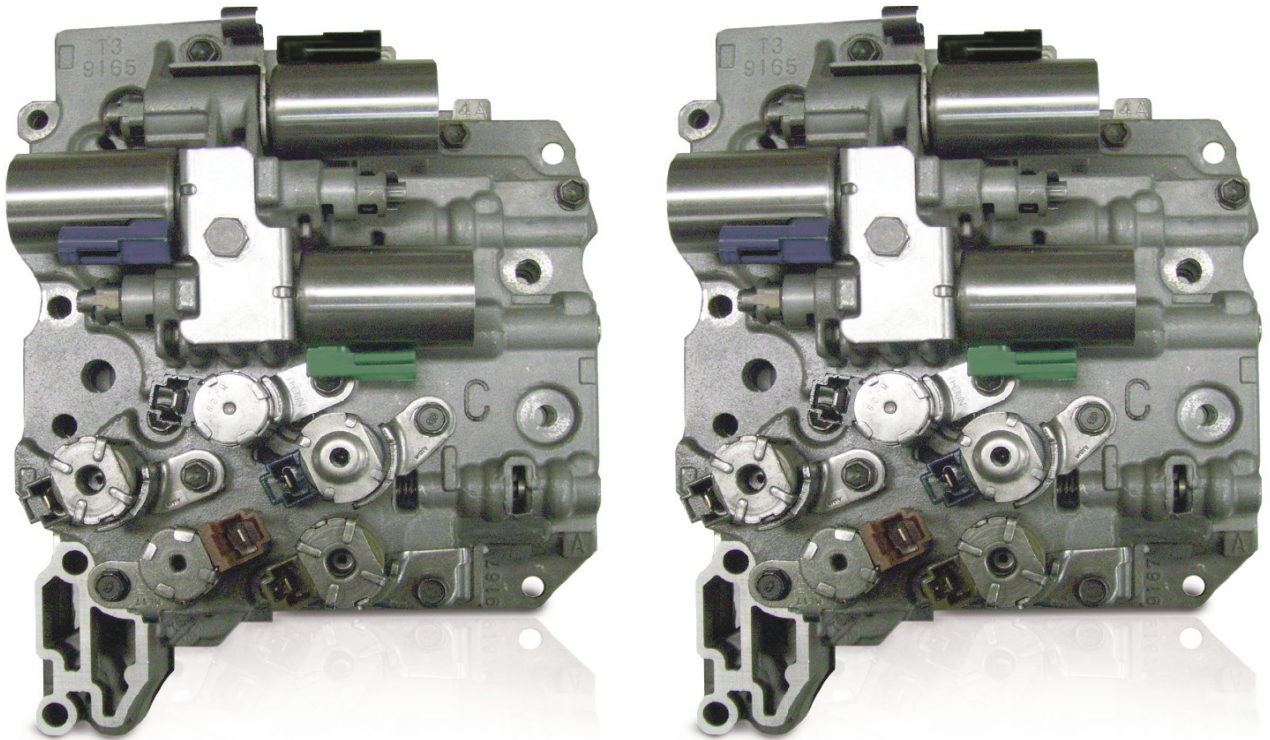
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Photos: Wayne Colonna





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Founded in 1953, Subaru made its presence known in the United States 15 years later. Interestingly enough, one year after that (1969), we landed on the moon, which I am sure had a better view of The Seven Sisters. They might have even seen the invisible sister from there.

The car that landed here on U.S. soil was called the Subaru 360. It took on the nickname "Ladybug" due to its similar appearance. (It also was called Ladybird in Europe.) It had an air-cooled 2 stroke inline 2 cylinder 356 cc engine mounted transversely in the rear. Sort of like its competitor, the VW Beetle called the Bug, it had a four-speed manual and optional three-speed-based "Autoclutch" transmission. It was called an Autoclutch because it was a manual transmission that eliminated the clutch pedal using an electromagnet to operate the clutch. That makes today's Sequential Manual Gearboxes with computer controlled slave cylinders not such a new idea. It wasn't until 1975 that Subaru began using an automatic transmission. It was a 3-speed by JATCO called the 3AT. By 1983, there was an electronic version of this transmission called the 3EAT with a Single-Range 4WD package.

A number of years later they phased out the 3 speed transmission using a 4 speed version, which was available in FWD and Full-Time AWD. It was called the 4EAT transmission. But as the years rolled by, significant changes took place

with the design of the transmission. As a result, the original 4EAT is referred to as the 4EAT Version 1 Phase 1. This transmission utilized a band for 2nd and 4th gear where shifting was electronically operated (Figure 2). Its powerflow and solenoid operation is that of a Nissan

RE4R01A made by JATCO (Figure 3). Around 1999, Subaru replaced the 2/4 band with a clutch assembly (Figure 4) along with a completely different valve body and solenoid arrangement (Figure 5). This style of transmission is called the 4EAT Version 1 Phase 2.



Figure 2

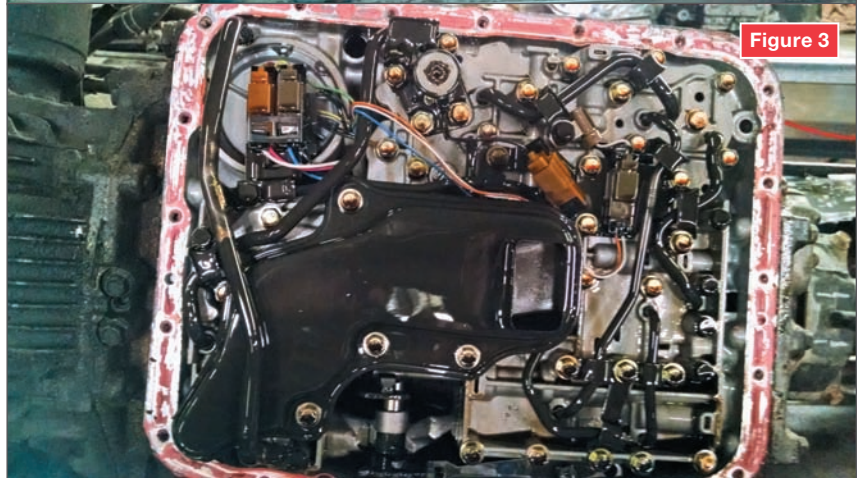


Figure 3

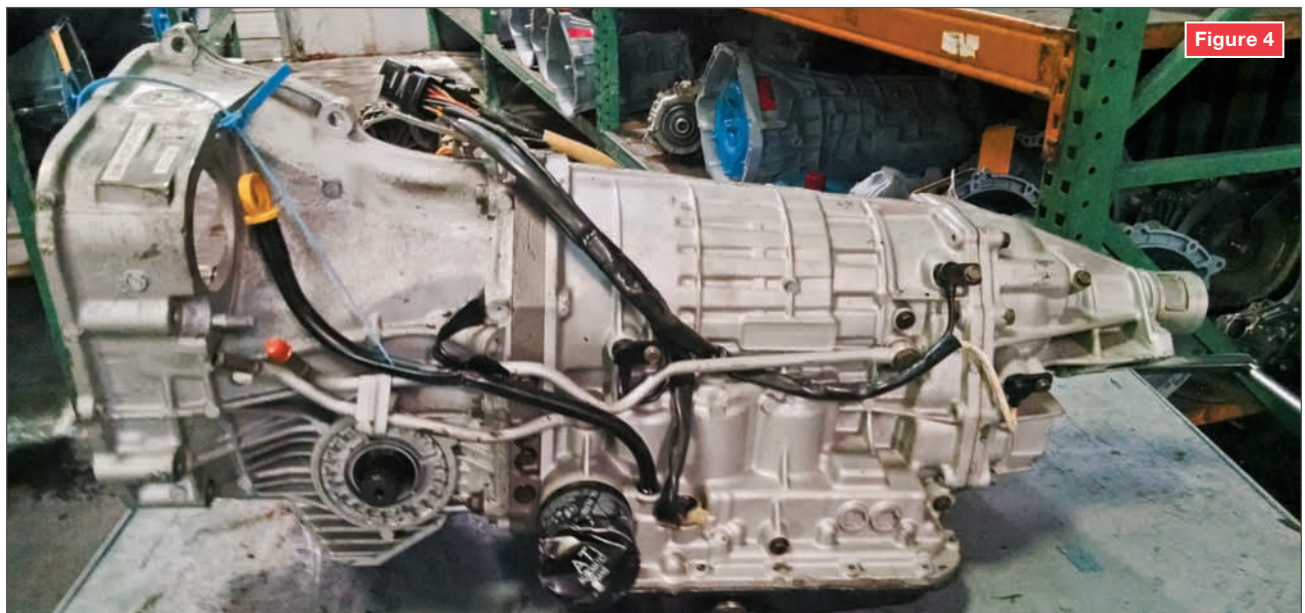


Figure 4

Part of these changes included AWD control. They use two types of traction control systems: Active Torque Split (ACT-4) and Variable Torque Distribution (VTD). Normally a FWD vehicle, ACT operates on a 60:40 split sending torque to the rear wheels when front traction loss is detected. The VTD utilizes rear traction control more frequently with a 45:55 split and typically is found in turbocharger performance model vehicles with the 5EAT transmission mentioned next.

The 2004 Forester Turbo was the first to receive a third change with this unit. It is called the 4EAT Version 2 Phase 2, which can be identified quickly by yet another noticeable redesign of the valve body and solenoids. This style transmission found its way into the Forester non-turbo, Impreza turbo and non-turbo as well as the Legacy and Outback vehicles. But 2009 was the last year this transmission was used. The models that did not receive Version 2 Phase 2 received a 5 speed 5EAT transmission with a sport shift package. This transmission is based on the JATCO JR507E



Figure 5

transmission which Nissan uses and calls the RE5R05A transmission.

Today, Subaru has committed its entire vehicle line to a CVT transmission called the Subaru Lineartronic CVT. There was a time when Subaru

brought a CVT into the United States in its Justy vehicle, which lasted only five years (1989-1994). This transmission utilized a metal powdered clutch between the engine and transmission. This electronically controlled magnetic

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clutch imitated a fluid coupling torque converter. Brushes running along side the neck would energize the assembly magnetizing the powder to stiffness completing the torque transfer from the engine to the drive pulley.

It was an interesting transmission to say the least. I remember how the engine oil cover would leak; oil would drip down and get the brushes soaked with oil. This prevented the metal powder to become magnetized causing the transmission to not move. Anyway, primarily a FWD transmission, the Lineartronic CVT doesn't come close to this design. Externally, the design looks similar to the familiar 4EAT transmission (Figure 6). Internally is a different story all together. The only similarity would be the transfer clutch supplying torque to the rear wheels.

### Discovering the Transmission

One of the common complaints we have had on all three style 4EAT transmission is tight corner braking. This is when the wheels hop and skip across the pavement during low speed turns. This is typically caused by a malfunction in the AWD operation of the transmission.

To break this down, in Phase 1 Version 1, the solenoid attached to a 2 valve control body used to apply and release the transfer clutch located in the extension housing (Figure 7). In Phase 1 Version 2 this little assembly was located in to the rear of the transmission (Figure 8). In both versions, when the solenoid was turned off it applied the transfer clutch delivering torque to the rear wheels. Energizing the solenoid would release the clutch

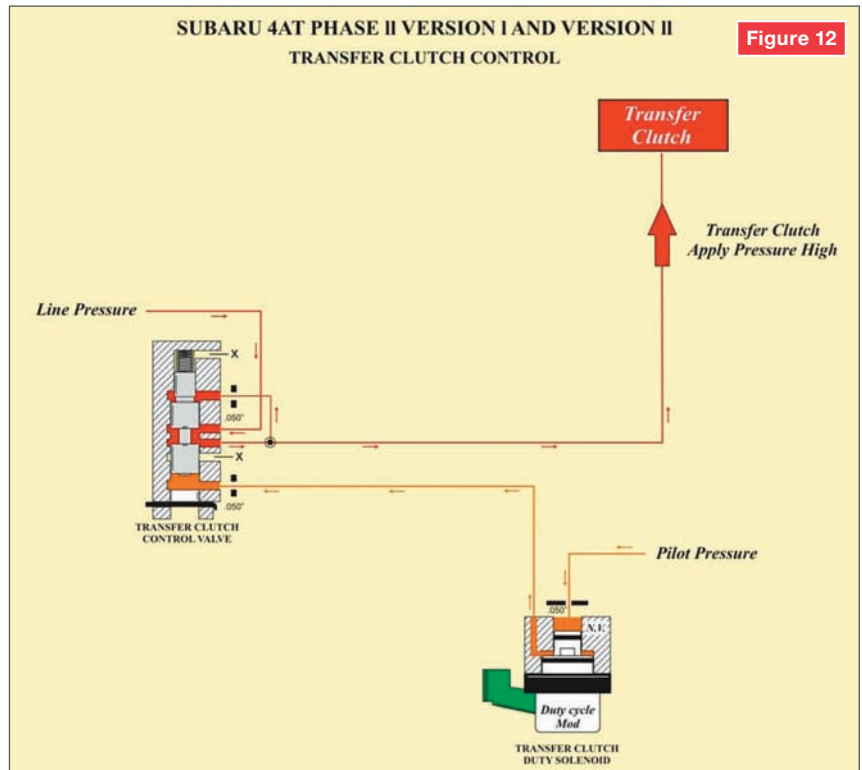


Figure 12

which is to occur during tight cornering to prevent wheel hop.

In the previous “The Many Changes to the Subaru 4EAT” article, it discusses how Subaru provided a test fuse located under the hood called AWD. It is purposely empty. When you insert a fuse into the holder, it will energize the Transfer Clutch Solenoid. If the wheel hop problem is eliminated than an external related issue (ABS/Wheel Speed system) is responsible for the problem. If the problem remains, the problem is internal related to the transfer clutch solenoid, transfer clutch valve

body assembly or the transfer clutch.

Phase 2 Version 2 is a completely different story. The entire hydraulic control of the transmission changed affecting computer hardware, software, solenoids, valve body and case passage. Part of these changes eliminated the little transfer clutch valve body assembly and relocated the solenoid to the main valve body (Figure 9). This solenoid can be quickly identifies as it is the only one with a green connector (Figure 10). This is a Normally Vented solenoid which means it needs to be energized

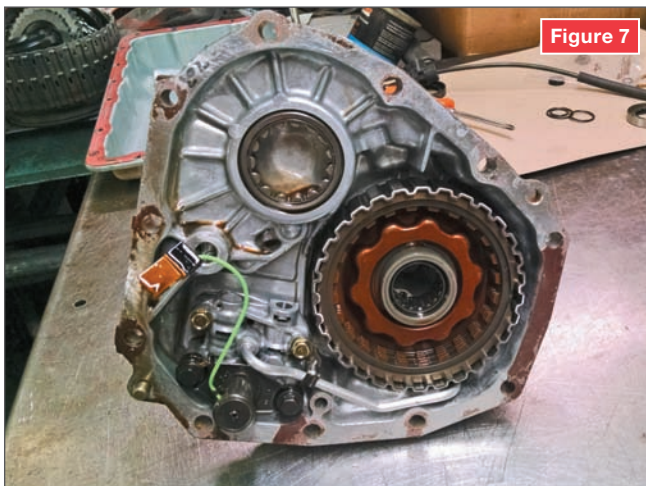


Figure 7

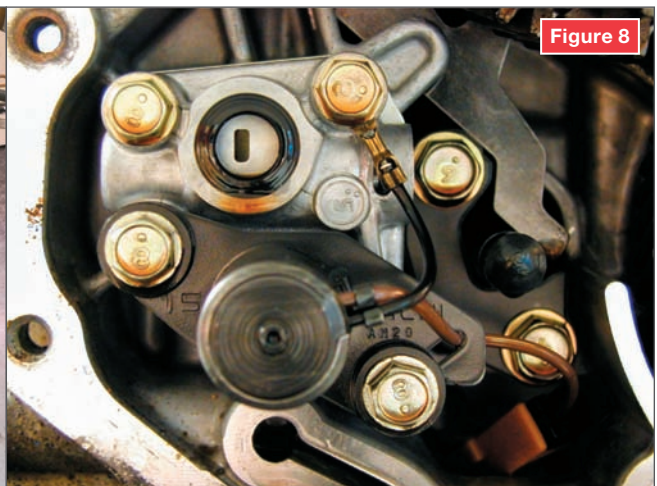


Figure 8

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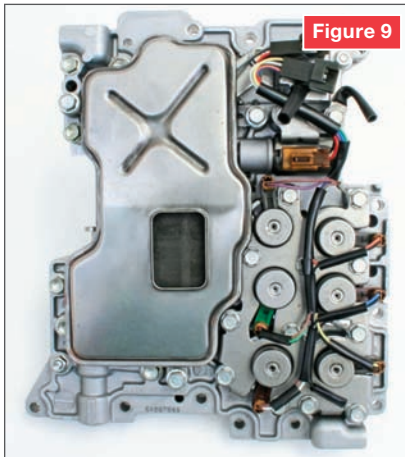


Figure 9

to engage the transfer clutch; just the opposite of the two previous designs. This also eliminated the AWD fuse holder in the engine compartment due to this strategy change.

The solenoids with the grey and brown connectors control clutch apply (Figure 11). They are all Normally Applied solenoids which means to turn a clutch off the solenoid needs to be energized. The snout diameters for the grey solenoids are 1.265 inches (TCC, High Clutch and L/R Clutch). The snout diameters for the brown solenoids are 1.365 inches (Low Clutch and 2/4 Clutch). The transfer clutch solenoid

with the green connector has the same snout diameter as the brown connector solenoids (1.365 inches). This means "self-inflicted transmission malfunction" as the brown and green solenoids can be poked into the wrong location. So care needs to be given here when changing solenoids.

The new design transfer clutch solenoid receives pilot pressure through a .050-inch orifice into the tip of the solenoid's snout. When the solenoid is off, the supply pressure is blocked from passing through the solenoid. When the solenoid pulse width modulated by the computer, pilot pressure



Figure 10

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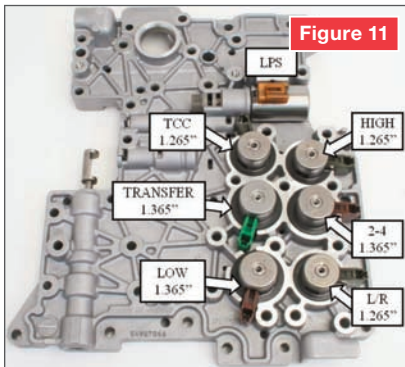
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passes through the solenoid to the transfer clutch control valve. This valve is being held closed by spring tension. Along side the valve is a line pressure supply waiting to be routed to the transfer clutch.

When solenoid feed oil enters the face end of the valve opposite the spring end, pressure builds to overcome the spring force stroking the valve. Once the valve moves, line pressure is then directed to the transfer clutch. The way the solenoid strokes the valve, it allows for a controlled apply of the clutch as well as a controlled release of the clutch.



The failure that can occur here is the solenoid mechanically fails where it will apply the transfer clutch without it being energized. This happens to be a common problem with this solenoid. The bigger problem is the solenoid cannot be purchased separately. The entire valve body assembly needs to be purchased which includes all the solenoids listing for a bit over \$900. Watch for an in-car repair with a work around for this dilemma which will be in a weekly March 2015 email newsletter.

Other causes for the transfer clutch to remain applied besides a mechanically failed solenoid would be a transfer clutch control valve stuck in the applied position, or the friction and steel plates in the transfer clutch drum have become so overheated they seized together. A couple of reasons for this will be discussed in one of the weekly March 2015 email newsletter as well.

Does anyone know what Impreza means? Someone told me it is a Polish word for "show." Maybe it is referring to the Premier show with the Patriot



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and his wife. If so, The Seven Sisters should be attending. My guess is that with their Legacy they might be going Crosstrek through the Forester from the Outback.



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Voltage drop testing across a fuse is the author's preferred method for finding parasitic draw concerns.

# NOT JUST A FUSE BOX

THE HOME OF VEHICLE POWER MANAGEMENT ONCE KNOWN AS A 'FUSE BOX' HAS UNDERGONE SOME SIGNIFICANT CHANGES DUE TO THE PUSH FOR INCREASED FUEL ECONOMY.

BY **DAVE MACHOLZ** | CONTRIBUTING EDITOR

Vehicle manufacturers and engineers constantly are exploring ways of refining and improving on-board technology. In the search to make lighter, more fuel efficient vehicles, no stone can remain unturned. The home of vehicle power distribution, the “fuse box,” has undergone some significant changes as a result of these efforts. We’ll take a look at what’s new in the fuse box as well as some diagnostic approaches for some of the problems related to power distribution.

When you think about how far we have come in terms of electricity and electronics, it is astounding. Growing up, I was in love with the classic Ford Mustang. (OK, I still am). My grandpa had a 1964 ½ convertible, my uncle had a 1966 Fastback, and after being

around those cars, I had to have one of my own. Working in a service station for a few years allowed me to save up some cash and with some help from my grandfather I finally got a red 1967 coupe with a 351 Windsor V8. I remember changing the old glass-style fuses when we restored it, as the fuse box looked a little crusty after many years of service. I think there were a grand total of seven fuses! That little fuse box couldn’t have been more than four inches square.

In 50 years, things definitely have changed. Today’s power distribution centers do a whole lot more than provide a fused pathway. They need to provide power to an innumerable amount of onboard electronic devices and at the same time they have to do the job with less weight.

### Fuse Box on a Diet

All of us have known someone who has had success with weight loss. Oftentimes it’s the process of counting every single calorie that leads to their drop in weight. This idea is somewhat similar to what an automotive engineer goes through to make a vehicle lighter. Every single piece on the car contributes to the vehicle’s overall weight. By reducing components and/or the weight of an existing component, we can drop the overall weight of the vehicle and in the grand scheme of things reduce the vehicle fuel consumption. So how do we put a fuse box on a diet? There are several ways that manufacturers are making these changes.

**Three Prong Fuses:** Three prong fuses? Yes you read correctly. You can expect to see these put to use in great

Photo: Dave Macholz



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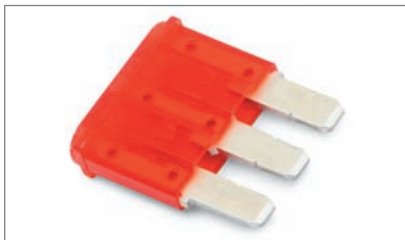
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numbers before too long. These fuses, known as ATL or Micro 3 fuses, take up a little more space than one traditional micro fuse while providing power to two circuits. The center of the three prongs is the common power supply for each side of the fuse. This gives vehicle manufacturers a way to better utilize space while providing a weight reducing solution for power distribution systems.

Testing these should be done in the same manner as the two-prong fuse. When the fuse conditions for power have been met, the center prong should have power when testing with a Digital Multimeter (DMM). Place the black COM meter lead on battery ground and the red meter lead at the center test point on the top of the fuse and set your meter to read DC voltage. Each of the two outer test points also should show source voltage if the fuse is in good working order. If your initial voltage checks show a voltage other than expected, you will have to do some fur-



Three-prong fuses are a space and weight saving solution for the fuse box. The Micro 3 and ATL are available through companies such as Kimball West.



A voltage drop reading of 2.8mV DC indicated that current was flowing in the courtesy light circuit on this Honda vehicle.

ther testing to determine the root cause of the problem.

**Integration Relays:** A few years back, I gave the students in my college electronics class the task of disabling the fuel pump on a 2010 Toyota Camry in order to perform a fuel pressure test. The factory schematic showed what looked to be a four-pin relay in the under-hood junction box. The students came to the conclusion that removing the relay would be the easiest way to disable the pump.

After searching for the relay for about 15 minutes, my students gave up. I knew the feeling because I've been there myself. Here was something as simple as a four-pin relay and it was kicking their butt. The reality was that they were not looking for a four-pin relay at all. Even though the factory electronic wiring diagram shows what looks like a four-pin relay, it is actually a transistor, or more likely an integrated circuit (IC). This IC device known as an integration relay takes the place of multiple traditional four-pin relays reducing overall vehicle weight.

So why show this as a four-pin relay? Because Toyota engineers most likely felt that technicians would be able to understand and identify this component's function as a relay. After all, it functions the same way, right? The problem with their thinking is that it doesn't look the same as its four-pinned, contact-type counterpart, and it can't be tested in the same manner as a four-pin relay. When looking at Toyota electronic wiring diagrams, be sure to note if the relay in question has terminal numbering. A relay that appears in an area of the diagram that is shaded in grey is part of the integration relay. A relay that has numbers for terminals will be a traditional relay.

After seeing this myself for the first

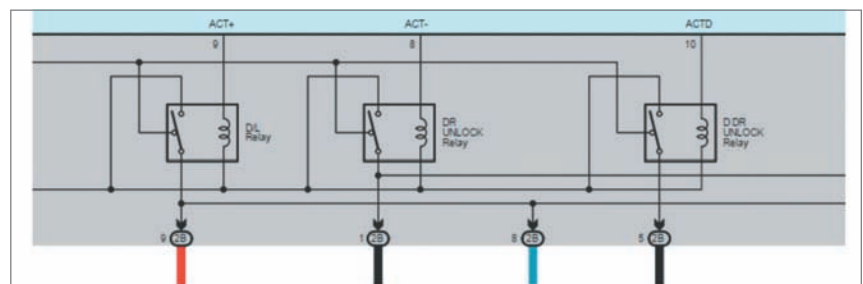
time, I decided to do a bit of digging. I looked up how many four-pin relays came on a 2001 Prius as compared to a 2010. The 2001 has 24 relays; the 2010 has relays that can be counted on one hand. An integration relay replaces the rest. The integration relay allows for a fairly large reduction in weight of the power distribution center or fuse box. Though it seems like a small step, every ounce counts.

One additional benefit to using a solid state relay as opposed to a traditional relay is that the solid state relay takes far less current to operate. By eliminating 22 relays and replacing them with a solid state IC device there is far less electrical load for the alternator to power. This is a simple way of achieving a power and weight reduction but many manufacturers have taken this a step further.

## Solid State Power Distribution and Management

All vehicle manufacturers are concerned with the overall power needs of a vehicle. The more loads that are turned on, the more load we put on the alternator. The byproduct of producing a high current output from the generator/alternator is the drag placed on the serpentine belt by the increased magnetic strength of the field winding inside the alternator.

This parasitic drag leads to increased fuel consumption. For this reason, many manufacturers have taken steps to control power management. They are achieving this management through the use of solid state electronic devices. In plain English, they are using ECUs or modules. In some cases, the fuse box itself becomes a module that might need to be programmed/re-programmed when it is repaired or replaced. Let's take a look at a few of



Toyota / Lexus integration relays can be identified by their lack of terminal numbers as well as the gray shading around them.

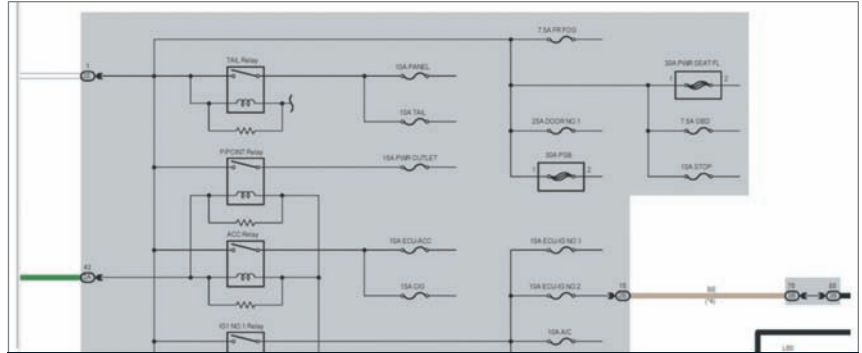
the integrated module/distribution systems, and in particular a few that may cause some problems in your bays.

### Ford: Smart Power Distribution Junction Box – The SPDJB

Ford's smart junction box (SPDJB) was designed in partnership with its supplier, Lear. According to Lear's website, Smart Junction Box technology is the main hub in a vehicle's electrical system, controlling and providing power to various electrical features such as power windows, power door locks, lighting (interior and exterior), instrumentation and the audio system. Current Smart Junction Box technology combines fuses, relays, a micro-controller and multiple (circuit board and fret) layers of interconnection into a single integrated assembly. Its job is to provide protection against excessive current loads, typical of a short circuit, by shutting down circuit function.

Being that the SJB is a module that is software driven, there have been some issues with these units. Some of the problems can be addressed with reprogramming. This reprogramming typically will require the use of a Ford IDS scan tool platform. If you are attempting to use aftermarket scan tools, be sure that the tool you are using will perform the task at hand before proceeding. It may be helpful to have a reliable mobile diagnostic service a phone call away when replacing these units without the proper tooling to avoid sending your customer back to the dealer.

Problems that can't be fixed with software updates or programming typically will result in replacing the entire smart unit which can be a costly proposition.



Power distribution schematics provide a great starting point when diagnosing complex power distribution problems.

Photo: Toyota/Dave Macholz

### Nissan Intelligent Power Distribution Module – IPDM

The IPDM is Nissan's answer to power management. It works on the same basic principles as the Ford unit. When working with an IPDM unit, be sure to note that the only serviceable parts of the unit are its fuses.

There is an exception to this with certain Technical Service Bulletins (TSBs) that require you to use a special relay puller to remove the ECM relay on certain years and models. If you are not working with a TSB, do not attempt to remove any relays from the IPDM device. As with any diagnostic routine be sure to check service bulletins when dealing with power distribution problems. Problems with the IPDM that can't be fixed with software will typically require the replacement of the entire IPDM.

### Chrysler: Totally Integrated Power Module – TIPM

The TIPM is Chrysler's version of smart power distribution. The TIPM is a module and has serviceable fuses and solid state switching with typically no relays.

The TIPM has been the subject of several recent recalls that can result in symptoms including no start the first time, no start at all, a failure to keep running once started, fuel pumps that won't shut off and stalling. Be sure to check service campaigns and TSB's when working on late MY Chrysler vehicles that are exhibiting these problems.

### Diagnostic Strategies

As with any new technology, there will be a learning curve when diagnosing the modern day power distribution center. Basic use of a multimeter and labscope are essential. Without a fundamental ability to diagnose electrical faults, you are in for a painful experience. Many of the faults within the power distribution system will require the use of a scan tool, preferably of the factory variety.

### Power and Ground Distribution Schematics

Power and ground distribution schematics are invaluable in diagnosing electrical faults. Understanding what the power source is, what circuits share the power and ultimately where the circuit is grounded can help you determine whether the problem you are dealing with is isolated to one particular circuit or if seemingly unrelated electrical problems could be related to a power distribution device such as an IPDM, SJB or Integration relay. Familiarize yourself with power and ground distribution schematics. You will be thankful that you did.

### Modern Parasitic Draw Testing

Most of us know by now that disconnecting the battery when performing

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parasitic draw testing is a bad idea, especially with advanced power distribution technologies. So what is the solution?

My draw testing always starts by prepping the vehicle and removing sources of interference with onboard modules:

- Close doors and lock them with the key fob.
- If the hood is open, be sure to close the latch with a screwdriver. Be sure underhood lamps are out.
- Move keys at least 10 feet away from the car.
- Make sure any Bluetooth device such as a smartphone or Bluetooth headset is removed from the vehicle.
- Wait for a few minutes for the remaining modules to go to sleep. Take your time and go make money fixing something else for now and come back to this when you are done.

The last two bullet points are the ones that I find that most techs are overlooking. If the vehicle uses a smart entry system such as Toyota's smart key, having the key in close proximity to the car will wake up the modules associated with the entry system and in many cases will turn

on the lighting in the vehicle. Toyota suggests keeping the smart key a distance of at least 10 feet from the vehicle when performing parasitic draw testing.

In addition to keys, smartphones and other Bluetooth devices can be a problem. If a Bluetooth-connected device is connected to a system such as the Hands Free Link (HFL) system on Honda vehicles, the Bluetooth device might continue to have communication with the module. Removing smart phones and Bluetooth devices will eliminate the possibility of these devices keeping a module awake.

When all preparations are made, it is time to proceed with isolating the circuit that is causing the draw. My method of choice is using my multimeter set on DC volts and voltage drop testing across the top of each fuse until I find one that seems to be flowing current. Let me explain.

The only time current is flowing in a circuit is when the circuit is powered or turned on or is shorted and flowing current. Using a meter set on DC volts and performing a voltage drop test provides me with an indication if current is flowing or not. There are charts available that correlate voltage drop to the amount of amperage draw but I don't rely on them as gospel. I prefer to find the one that seems to be drawing the most. You will find that typically the one with the highest drop is your offender. Once I locate the circuit I will print a power distribution schematic for that circuit. Once I see what the fuse is powering I can start pinpoint testing.

I had a chance to use this technique with an Acura product that recently had been in an accident. When the car was returned to the customer by the collision shop, the battery would die overnight. The customer replaced the battery and yet the battery continued to die. I used the voltage drop method to isolate the draw to the courtesy light circuit in under five minutes. I think you will agree that is pretty quick and it has nothing to do with my level of intelligence. It has everything to do with my chosen method.

After isolating the circuit, I found that the body shop had removed the courtesy lamp for the rear hatch, as it was staying on. As it turns out,



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the body shop had the hatch striker installed upside down which was not allowing the hatch to completely close. Once I correctly installed the striker, I had it fixed. If only every parasitic draw diagnosis could be this easy! It can be if you are using modern diagnostic techniques.

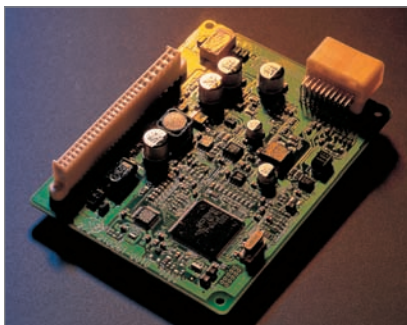
If the multimeter voltage drop strategy won't allow you to locate an intermittent draw, you might want to enlist the help of a lab scope. Using a lab scope with a low current probe will allow you to see a picture when a particular current draw is occurring. Having a picture of a draw on the screen can be extremely helpful in locating faulty modules.

Constant changes in technology make our job as technicians challenging. Embracing new technology and accepting the challenge will help you make money instead of losing it when it comes to diagnosis. *TM*



Dave Macholz is an instructor for the Toyota T-TEN, Honda PACT and general automotive programs at Suffolk County Community College in Selden, N.Y. He is an ASE CMAT and L1 technician and holds a NY State teaching certification in vehicle repair.

 E-mail Dave at [liautotraining@gmail.com](mailto:liautotraining@gmail.com)



Denso and Toyota partnered to create this power management ECU that allows Toyota to simplify its power management systems.



Integration relays are solid state devices that take the place of traditional four- and five-pin relays in order to reduce weight and lower power consumption.





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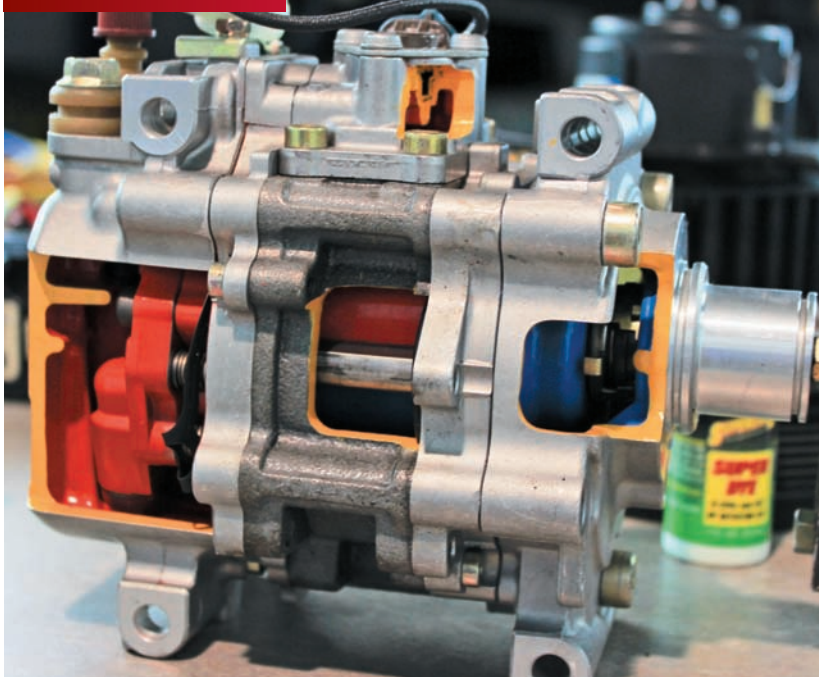
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# WELCOME TO THE HVAC CAFE

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BY **DAVE HOBBS** | CONTRIBUTING EDITOR

**E**ver wonder why HVAC systems are getting such low charge capacities from the factory? Do you have customers who seem to complain about hit and miss fuel economy on their hybrid electric vehicles? Have you run into RECIRC buttons that didn't seem to stay in recirculation mode or encounter a condenser that had refrigerant passages that were smaller than a needle? The OEMs have answers for every one of these questions, and those answers aren't always about improving the carmaker's profits.

The answer often is rooted in fuel economy. Everyone knows that automotive air conditioning and fuel economy are not friends. Want to get better economy? Turn off the A/C. It's that simple. But most people would rather stay cool than save fuel. OEMs today are working hard at doing both. Ever since CAFE began to stand for Corporate Average Fuel Economy instead of a place to get a bite to eat, vehicle manufacturers have strived to avoid the federal government imposed fine for every 0.1 mpg they exceed the magic CAFE number. These

finances are levied for each vehicle they sell in a model year in which they miss that CAFE mark.

That mark is the average of all the gas guzzlers and economic models sold. If you're going to sell large comfortable vehicles that buyers want, you're going to have to have a lot of small improvements in fuel economy that all add up.

### The Birth of Cycling Clutches

Many techs wrenching today don't remember Pilot Operated Absolute (POA) valves. They were common components before cycling clutches and variable displacement compressors. In those days (1960s and 1970s), the compressor ran all the time when the HVAC control head was set to an A/C or even defrost setting (to dehumidify the air in defrost). On some luxury models, the compressors ran all the time, period.

Those days were gone forever when in the late 1970s GM's first Cycling Clutch Orifice Tube (CCOT) system came out as a reaction to rising fuel prices that came into reality after the OPEC oil embargo of that decade. The

reasoning was the POA valve working with the expansion valve did a good job of dropping high pressure warm liquid refrigerant to a low pressure cold liquid but keeping the cold liquid from getting so cold that the evaporator would freeze. That low side in the evaporator might have been getting so low that the evaporator's sweaty coils were about to frost.

The old POA valve kept this from happening, but as engineers found out, so did shutting off the compressor for a few seconds every so often when the low side pressure got too low. Cycling clutch vehicles with either orifice tubes or expansion valves are still coming into our shops today, but a newer breed gradually has taken over. Smaller engine displacement means larger fuel economy numbers of course, but it also means less power when all other factors are equal. As vehicles downsized along with their engine displacement, the 100 percent load of an A/C compressor followed by the clutch switching off that load completely often induced a bit of an annoyance with drivers feeling that same load on the engine come and go.

Photos: Dave Hobbs

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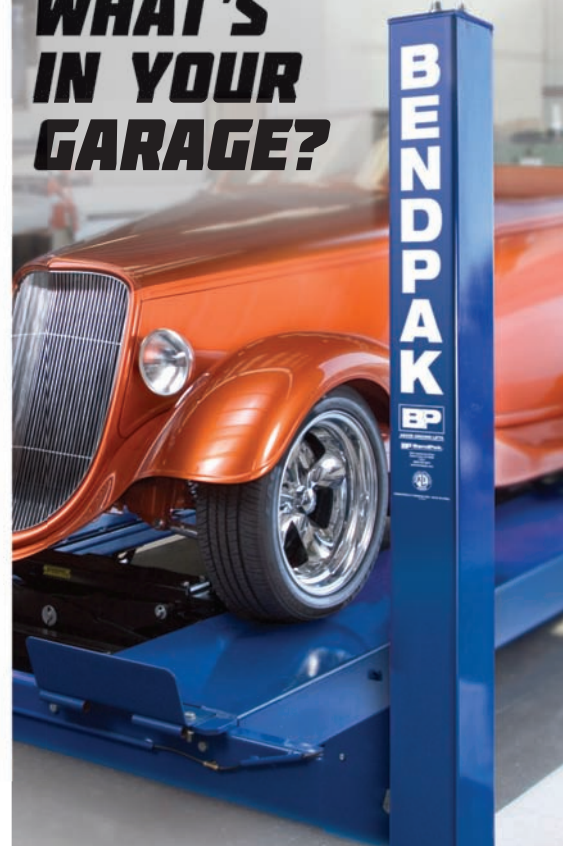
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## The Birth of Variable Displacement Compressors

In effort to allow a lower load on the engine and still keep the evaporator cold but not freezing (keep cool and save fuel), the variable displacement compressor became the invention mothered by necessity. Many of us recall that annoying surge on CCOT systems when engines were downsized to increase CAFE. Those fuel sipping transverse mounted engines were first to receive the variable displacement compressor to prevent the impact of 100 percent on vs. 100 percent off compressor load. Although those compressors have been out for over a decade a learning curve still exists.

## A CAFE Favorite: The Wobble Plate Special

Axial style compressors (using no conventional crankshaft) have been around since the early 1960s when the Frigidaire A6 compressor came out. It had a swash plate that wobbled back and forth to cause the six pistons inside the compressor to move their full stroke at all times. Those old compressors were physically large and heavy — well more than 30 pounds and the full stroke at all times required a lot of energy for the engine to turn.

Moving to today's variable displacement axial compressors, the heart of these lighter and easier to turn compressors is the wobble plate. Similar to the A6's swash plate, this plate has the pistons attached via connecting rods. When the wobble plate is at an angle greater than 90 degrees in relationship to the input shaft, it wobbles back and forth causing the pistons to move back and forth in their stroke. When the wobble plate is nearly 90 degrees in relationship to the input shaft, it has very little wobble to it, therefore the pistons make a very slight movement back and forth in their stroke. A single shaft with a brass bushing for the plate to angle back and forth on kept the plate at the desired angle controlled by the valve in the side/back of the compressor.

The compressor inlet side (from the evaporator) is applied to one side of the valve while the compressor's internal pressure is applied to the other side. When the evaporator pressure drops low enough that the temperature of its coils might begin to freeze any condensation

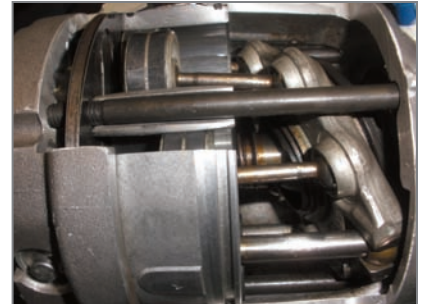
of water droplets on its fins, the valve does its job to limit the displacement. Less output means a lower high side pressure. It also means less condensed and cooled (courtesy of the condenser and orifice tube/expansion valve) refrigerant to cool those evaporator fins. Later variable displacement compressors utilized electronic control valves.

## Diagnosing Variable Displacement Compressors

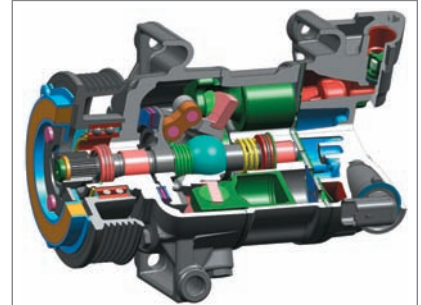
Here is where the rubber meets the road. If you are used to reading pressures on your gauge set as your only method for determining system charge and component restrictions, you are going to need to make some adjustments. If a variable displacement compressor's wobble plate gets stuck in a lower displacement position, cooling will be poor and both the high and low sides will be low as if you had a low charge or a bad compressor. If the wobble plate gets stuck in a high displacement position, you will have the symptom of a restricted / froze up evaporator.

Because a low charge and over charge can emulate other problems, you are time ahead to do a recovery and recharge with the correct amount of refrigerant to set a baseline. Now if you don't see any component freeze up spots indicating a restriction and it appears the compressor is not pumping any or not throttling back to prevent too much of a drop on the low side, then you likely have a compressor displacement control problem. If the displacement control is electronic (we'll cover that next), you naturally would check that out prior to going after the compressor.

If the variable displacement control valve is mechanical you have two choices. The first choice is to try a new control valve. There are some applications with part numbers available for a reasonable price. The problem next lies with the R&R, not to mention another recover and recharge. Most techs go with a second choice — a new (or reman) compressor. Naturally if the compressor is noisy or inlet screen/orifice tube screen inspection reveals some nasty metal and debris, you replace the compressor. A few HVAC specialists will survey the control valve R&R option and if the compressor doesn't have to be removed to replace the valve and one is available for a reasonable price,



These two photos of a cutaway CVC show high displacement (top) and low displacement (bottom).



This 6-cylinder Compact Variable Displacement Compressor (CVC) uses a swash plate that pivots on a hinged mechanism to vary the angle (therefore displacement) of the plate that causes the pistons to move.

Photos: (TOP) Dave Hobbs; (BOTTOM) Delphi

they give the cost conscience customer the "we can try this with a slight risk" speech and pop in a valve.

## The Death of Compressor Clutches

Many mpg conscience models have dropped the spare tire and jack in favor of a compressor with tire sealant or run flat tires. Lighter rims, aluminum body panels and more and more composites (what engineers call plastic) throughout the vehicle all add up the weight loss CAFE diet. Even CD players have been lightened up along with of course more multiplexing (CAN networks) to reduce the weight from wiring. So there is one word on why A/C compressor clutches are disappearing: weight.

A typical clutch, bearing and coil weigh about five pounds. That's about what a laptop computer weighs. Subtract the weight of the pulley and doing away with a clutch drops two or three pounds from the car. The advantage of a consistent load comes into play when the clutch is gone but a slight penalty in winter for a little more drag factors in. There has to be a protection mechanism such as a shear pin to allow the accessory drive belt to continue operation in event the compressor locks up.

In order to go clutchless, the PCM and HVAC controls have to have an alternative method of controlling when the compressor runs and how hard it works. Electronic control of the variable displacement side of the compressor is how it's done. GM has adopted a CVC solenoid. Toyota has done the same. Scan tool PIDs for the newer GM compressors display duty cycle percentage for the solenoid controlling the compressor displacement.

If you can't read that PID on your scanner, you can always grab a DMM with the duty cycle function and watch the percentage increase as you dial down the temperature on the control head. Toyota, on the other hand, places a pressure sensor in the case of the compressor (along with the traditional one in one of the A/C lines) that gives an analog feed back to the HVAC controls which is easy enough to measure with a DMM. The PID for the compressor displacement solenoid has a little twist though. It is displayed on the data stream in current (amps) which of course corresponds to the average on vs off cycling of the solenoid. A DTC sets if the pressure isn't matching the solenoid's commanded state.



The High Voltage (HV) electric compressor contains a small inverter to change the DC into AC. The high and low side pressures are controlled by compressor speed via a CAN bus message to the compressor's inverter.

## The Ultimate Fuel Dieters

Hybrid Electric Vehicles, (HEVs) Plug-In Hybrid Electric Vehicles (PHEVs) and Electric Vehicles (EVs) are vehicles that have been around for many years surpassing any suspicions of them being a fad. Though the cost of gasoline has dropped drastically at the time of this article's creation, history shows the real fad is low gas prices. They'll likely go back up again for whatever geo political reason you want to name.

Using the "P" word again (politics), the feds and folks at the California Air Resource Board (CARB) always are on the prowl to create requirements that drive fuel economy up and emissions down. Future CAFE requirements are the biggest hurdles seen by automakers in decades. Carmakers don't like to be caught off guard paying fines for every vehicle they sell when CAFE standards are met, so the quest goes on to reduce fuel consumption and tailpipe emissions.

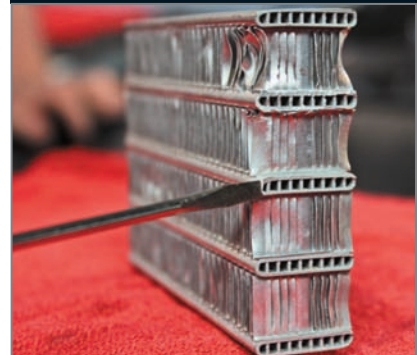
Electric compressors are the standard now for all but the wimpiest hybrids (GM Malibu, Saturn Vue Greenline, etc.) but that wasn't always the case. Ford midsize hybrid SUVs (Escape and Mariner) used a mechanical compressor from 2005 until 2009. Some Hondas used a compressor that was 2/3 mechanical belt driven with the remaining rear 1/3 of the compressor being orange cable/high voltage (HV) fed. On those early Fords and the GM BAS/E-Assist (Belt Alternator Starter), if you have a customer that complains of insufficient cooling or reduced fuel economy, the usual suspect still apply along with a very simple solution: education.

To bring as good of fuel economy into summertime driving as possible periods of idle stop are favored over the most aggressive compressor operation. On these vehicles, because the compressors are mechanical, the engine (or internal combustion engine (ICE)) must remain running at stoplights. This is exactly what you do not want to do if you are going for fuel economy.

HEVs often get more impressive economy in city driving than highway driving because of regenerative braking and idle stop. Owner's manuals for HEVs with mechanical compressors clearly describe the two modes for A/C operation. As an HEV technician, you must understand HVAC controls for hybrids due to the fact many of your



Early generation hybrids had mechanical or part mechanical/part HV electric compressors.



The condenser cross section (top) is a serpentine tube condenser (STC) that has had a much smaller tube diameter for several years. The most recent generation of lightweight condenser (bottom) called the parallel flow condenser (PFC). The weight reduction / heat exchanger density is excellent but at the cost of contamination resistance. These condensers cannot be flushed.

customers don't read their owner's manuals. GM BAS systems use a bi-colored LED to indicate "Econ" (green) or "Max" (orange) A/C compressor modes.

In the econ mode, the ICE will enter idle stop. As the refrigerant warms up from lack of circulation, an evaporator temp sensor signals the HVAC

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controls that the evaporator is getting too warm and the PCM commands idle stop to discontinue. The ICE (and mechanical compressor) restarts and it's back to staying cool. Your customer might notice the drop in cooling performance though. On the flip side, if it's hot enough outside that you don't care about passing gas stations and hugging trees, the "Max" compressor mode totally inhibits idle stop.

### RECIRC's Mind of Its Own

HEVs have high voltage battery packs that perform and last longer if they don't get too hot. Most use cabin air to cool them with blower motors mounted near the pack. In cases of extreme hot ambient temps, blocked HV battery pack air inlet vents or restricted blower squirrel cages/ductwork, the vehicle's hybrid electronics will take matters into its own hands.

On the mechanical compressor-equipped Ford/Mercury HEVs, the ICE will be commanded to run (no matter what) to get that compressor into action. Those models sported a rear A/C system complete with rear mounting cabin air filter, evaporator and blend door to move dedicated refrigerated air across hot battery packs. With a similar scenario on later model HEVs with electric compressors, the HVAC will command the A/C compressor to run and the recirc door will be closed (as soon as the in car temp is cooler than OAT) to give the cabin air that runs across the HV battery pack all the coolness it can get. This is regardless of whether the driver has opted for recirculation or fresh air.

### Electric Compressors

Twelve volts is not an efficient choice for powering an electric A/C compressor explaining why they've never caught on although moving coolant with a 12-volt pump works just fine. HEVs supporting 100 or more volts are perfect candidates for the CAFE stretching electric A/C compressor however. These compressors can run with the ICE off. It is normal to hear a slight growl from these high speed motorized compressors.

Toyota owners were given a choice on the Generation III models (2010 and newer) between hearing a little bit of noise (some owners found it objectionable) and having cold air or having a little quieter cabin during idle stop at the

expense of a little A/C performance. A TSB instructed that discussion between techs and owners prior to a HVAC module reflash that slowed down the compressor a bit. A/C compressors will bring down the State Of Charge (SOC) on the HV battery pack and that will make the ICE run as will a request for heat in cool weather.

The HVAC in any vehicle relies on the warmth of the coolant when the engine is running. Toyota and Lexus use PTC heaters mounted near their heater duct outlets to supplement engine coolant supplied heat. This isn't just a hybrid thing either. Other non-HEVs are using this technology of 12-volt supplied electric heater as well. Fewer than 100 watts will not warm you toasty warm, but it will help take the edge off the cold until the coolant warms up with engine operation. On PHEVs and EVs, cabin preconditioning is very important to program into the vehicle for those hours while the vehicle is tethered to its HV battery charger. Ford's Focus EV actually supplies the PCT (Positive Co-Efficient Temperature) heaters with the available High Voltage (HV) on board the vehicle to make this from of electric heat more effective and efficient.

### Refrigerant Capacity Reductions

You might feel old like me if you remember three and four pounds of R12 in some vehicles that came into your bay. Those were the days of adding a half of a pound to get the A/C system back into action in the springtime. Those days are gone forever. Systems well less than one pound accompany low mass (light-weight) heat exchangers like the newer Parallel Flow Condenser (PFC) that are in vehicles today. Lower capacity system means a talk with your tool vendor about a J2788 (SAE standard) RRR machine if your shop doesn't have one.

The over-the-top accuracy of this new standard in A/C recharge equipment is almost a necessity for doing the job right on today's lower capacity A/C systems. That also applies to correct oils, oil balancing procedures and OEM recommended practices regarding dyes and avoidance of sealants. Today's compressors are a lot more like an Indy car engine compared to the vehicles of the past. Toyota and some others are migrating towards mechanical compres-



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sors that have oil separators to retain more oil in the compressor (where it's really needed), thereby making still more inroads into reducing compressor load on the engine.

### Where Does It End?

The list of energy saving automotive HVAC technologies seems to just keep growing. If you think energy conservation technologies are just affecting the automotive industry, think again.

A lot more advances are in the works. For example, a New York university team just received more than \$2 million in funding from the U.S. Department of Energy to develop an active air conditioning vent capable of modulating airflow distribution, velocity and temperature in buildings. Look for that technology to migrate into automobiles someday. Wait, it already has! Toyota has an optional "smart vent" powered off of the solar panel available in the Prius. What will they think of next? *ZZZ*



**DAVE HOBBS**  
CONTRIBUTING  
EDITOR

Dave Hobbs is a field trainer and training product developer for Delphi Product & Service Solutions. He holds ASE CMAT/L1 and EPA 609 certifications and is an experienced hybrid instructor. Dave has been featured as an instructor in more than 15 automotive training videos.

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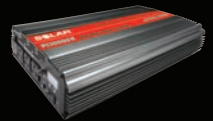
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# COMMON PROBLEMS, QUICK FIXES

## TIPS AND TECHNIQUES TO USE WHEN HANDLING COMMON A/C, HEATING AND COOLING SYSTEM PROBLEMS

Introductory image of heater and blower control with no AUTO setting.

BY VANESSA ATTWELL | CONTRIBUTING EDITOR

**D**iagnosing any vehicle's problems without properly testing and evaluating the system is not a responsible repair technique and pretty much is asking for trouble. But realistically, understanding common problems and the tips and techniques to verify the cause and fix it quickly and correctly really does save time and money for everyone involved. So it's smart to have a few diagnostic tricks up your sleeve.

From experience, certain heating, cooling and A/C problems tend to be caused by the same things and can be verified and repaired by understanding what they are and checking them right at the beginning of diagnosis. Plus, customers now tend to look up their

vehicle's symptoms on the Internet before they come in for service, and might have a strong opinion of how the problem should be fixed. You need to be ready to handle those suggestions and explain why Internet advice might not apply to the type of vehicle or concern the customer has.

That said, there's no substitute for proper diagnostic technique (developing a theory about what's wrong and then performing tests and taking measurements to support or discredit that theory until the root cause of the problem is found), understanding common problems and solutions just reduces the number of things to test to save time and money, rather than replacing the diagnostic procedure completely.

And of course, unless you're the luckiest person in the world (and even if you are), it's always a good idea to begin any diagnosis by visually inspecting the vehicle for obvious problems and checking for TSBs, programming updates and trouble codes and, of course, by pulling out the service information to be sure you understand how the system is supposed to work before you get started. One (excellent) service advisor I work with makes a point of asking the customer if they've left their system in "AUTO" mode when they bring in a vehicle with heating or cooling concerns to address the possibility that the customer just doesn't understand how their vehicle works and prevent the



SM

# BE SYSTEM SMART

Combine belts and tensioners, water pumps and hoses, and use timing component kits for a complete system repair. When components wear, they put the entire system at risk. The best way to prevent costly system failure is to remember the Car Care Council's recommendation. Start inspecting the serpentine, cooling and timing systems at 60K miles, and replace worn components by 90K miles or as advised by the manufacturer.

THINK **I-60** & **R-90**



technician from chasing problems that don't exist. Here's a list of some common heating, cooling and A/C problems and techniques to repair them quickly and effectively the first time.

### HVAC Airflow Problems

**Problem: Fan inoperative (Common cause: Blown fuse, likely because of motor problem such as binding or stiffness):** Typically when diagnosing a complaint of no heat or A/C it's a good idea to check that the problem simply isn't that the blower motor doesn't work – especially if the complaint is that the heat or A/C stopped working suddenly. Again, from experience, blower motors tend to fail suddenly rather than stop working slowly over time.

Typically, blower motor diagnosis involves inspecting the fuse, inspecting for power and ground at the motor (be sure to do that dynamically, using voltage drop) and checking for motor operation (either by supplying power or by removing the motor to see if it turns by hand). Even if the motor does sud-



Glove boxes are often full of things that could potentially escape out over the top and end up interfering with the doors and linkages that control the cabin temperature.



HVAC control cables tend to get knocked off or moved out of adjustment by the vehicle's floor mats – especially winter ones that aren't shaped to the floor.

denly operate when power is applied, it's still a good idea to spin the motor by hand to check for any binding issues.

Blower motors often are located in areas that allow water, debris or other material to get inside them and cause them to fail. That also means they're susceptible to creating problems with wiring, fuses and fuse blocks and connectors. In other words, if you discover a problem with the fuse or fuse block, it's worth inspecting the motor itself to make sure it's not the component causing all the trouble in the power supply system. If not, motor problems could cause the system to fail again a few days after the repair – not good at all.

If the problem is indeed a wiring problem rather than a problem in the component itself (and you're sure). I have one quick note to make sure the repair will last for a long while. When you're using electrical tape in the repair procedure, stretch the electrical tape to half its normal width, then wrap the electrical tape around the repair at least three times while continuing to stretch the tape, overlapping each wrap by half the width of the tape. This not only looks professional, it also seals the repair and ensures the vulnerable area will be somewhat protected.

**Problem: Noisy blower motor (Common Cause: Debris in the motor, or faulty motor):** Noisy blower motors often can be caused by leaves or debris that get into the motor through the air intake cowl, and this can be verified by removing the blower motor and checking inside it for bits of debris (it doesn't take much to cause a terrible noise and vibration). Cleaning out the foreign material and reinstalling the motor often fixes the problem.

Sadly for animal lovers, our rodent friends sometimes find their way into the heater system and then pass away inside the blower motor, which also can cause this problem. If that's the case, or if something has made a nest in the motor or vents, be sure to wear a protective mask and gloves during cleanup, because inhaling the fecal matter can be really bad for you.

Noise problems can also be caused by the motor itself – especially if the motor is located in a spot that easily exposes it to the elements. In these cases, the solution is to replace the motor and make sure the housing is



If you're inspecting or replacing the cabin air filter (which is easy enough to do), make sure nothing falls into the system while you're doing so.



Coolant comes in many colors. Cloudy-brown isn't one of them. Coolant should have a consistent, clear color.

free of dirt and debris or leaks that may cause repeat failure.

**Problem: Blower motor inoperative on certain speeds (Common cause: Problem in the control circuit):** On older vehicles, a blower motor that worked only on high almost always used to mean problems with the blower resistor. The solution typically was to replace the faulty blower resistor, which usually was a relatively cheap task. Additionally, the faulty resistor usually showed obvious signs of damage when it was removed (which was usually easy to do), so diagnosis was really simple and straightforward. If you wanted to check the resistor before removing it, you could test that there was power and ground and that its resistance wasn't 0 ohm – if it was there was a problem.



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However, newer vehicles often use controllers rather than a resistor pack to vary the voltage sent to the motor to control the speed. But these control systems still go bad, frequently on certain types of vehicles. In these cases, check for power supply and a good ground at the motor, and varying voltage when directed by the controller, to verify your suspicions.

**Problem: Insufficient air flow from air vents, but temperature is correct (Common cause: Clogged cabin air filters):** Newer vehicles often use cabin air filters and a clogged cabin filter can and does cause this low air flow problem.

Cabin filters use a very fine filtration filter, and they can get extremely dirty quite quickly and reduce the airflow into the vehicle to the point where it's really noticeable. The solution is replacing the filter, and the proactive solution is checking for this on regular a basis, such as during routine maintenance inspections.

One note though, is to be careful not to get any dirt or debris into the housing since this will cause more problems down the road. Move objects out of the way and wipe down the housing before removing the filter to prevent problems.

## A/C Problems

**Air conditioning inoperative (Common cause: Leak in the system):** If a vehicle comes in with a complaint of no air conditioning at all, quickly check to see if the A/C compressor engages (it probably won't). If it doesn't, check to see if there's actually any refrigerant in the system by attaching the gauges and noting the system's resting pressure. If it's empty or extremely low, there likely is a leak in the system that will need to be fixed before further diagnosis is done.

Hopefully, the cause of the leak will be obvious so you can locate it quickly, repair it, recharge the system and send the vehicle on its way. With this in mind, test for leaks using dye and UV light, a sniffer or by looking for oil stains on the components.

The most common leak sites are at the condenser (rocks or debris go through them or snow and salt collect and they rot out at the bottom), at the evaporator core, at the clamps where the lines are held against the body of the vehicle and at the fittings and connections of the A/C lines so it's smart

to check those areas carefully. Joints, fittings and welds usually are the weak spots in the system where leaks occur. If the A/C system was completely empty, hopefully the leak won't be hard to find.

**A/C not cold enough (Common cause: Slow refrigerant leak or problem with the linkage):** Usually low refrigerant levels caused by a slow leak in the system cause this. The fix is to repair the leak and charge the system to the correct level.

However, if the refrigerant level and system pressures are fine, the problem might be that the air mix door is binding or its controller is malfunctioning (which likely will cause fault codes that indicate the problem). Depending on the age of the vehicle, diagnostic codes might need to be manually read from the HVAC system controls after initiating the proper processor. It always is best to check the repair manual if you are unsure.



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If the pressure indicates the system is fully charged and there's still very little or no cold air from the A/C with the compressor engaged, there might be a blockage or restriction in the A/C system. If so, look for frost on the A/C lines under the hood. Depending on where the frost is this could indicate a blockage in the system, possibly from the expansion valve, receiver/dryer, or the condenser.

**Not cold enough in one zone or area (Common cause: Refrigerant level not quite perfect):** If the blend doors aren't binding and the controller is OK, check the refrigerant level carefully. Sometimes the system won't operate properly unless the exact amount specified for the system is in the system in order to work properly.

To evacuate the A/C system extra thoroughly to test this theory, run the A/C system for five minutes at about 1,000 rpm before evacuating it and then see how much refrigerant is recovered. If it's undercharged, test for small leaks,



Common locations for leaks on AC condensers, at the lower corners (both at the front and on the inside by the rad) and at the connections (especially ones exposed to the elements).



If there's no AC at all, check if there's any refrigerant in the system.

repair as necessary and recharge the system with the exact amount specified and recheck operation. If it's overcharged, put the correct amount in the system and recheck. Some systems really are that sensitive and correcting the refrigerant level is all it takes to correct the problem.

**Bad smell from the A/C:** A bad smell when the A/C is turned on usually comes from the evaporator core. There are excellent products that deodorize the components and eliminate the odor permanently, but in severe cases the fix is replacing the evaporator core (which can be extremely labor-intensive).

Prevent the problem from occurring in the first place by encouraging customers to run their A/C systems for half an hour each week during the winter (this helps defog the windows too) or operating the A/C system on road tests during regular maintenance.

## Heating System Problems

**No heat (Common cause: Air in the system, low coolant level):** One customer recently brought his vehicle in after his father-in-law replaced his coolant himself. He saved about \$100 by letting him do it, and then came to visit us the next day when the low coolant level indicator came on and the vehicle had no heat. Unsurprisingly, there was air trapped in the system circulating through the heater core and affecting system operation. Purging out the air, filling the system properly and clearing the trouble codes fixed the problems.

Low coolant level often causes low or no heat conditions, and if so, the customer also might notice a gurgling or sloshing sound from the dashboard, often more noticeable when the vehicle is steered hard in one direction.

If the system is low on coolant, carefully look for leaks. It seems obvious, but it's worth mentioning that coolant is bad for you when it's hot, because it can cause nasty burns. But it can also be bad for you when it's cold, because it's quite poisonous. Some older diesel techs I know avoid getting the long-life stuff on their skin and wash it off thoroughly when they do just to be safe. The material safety data sheets explain how to manage coolant responsibly so you don't have health problems later on.

Leaks at the water pump also are quite common on many vehicles, so



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inspecting that area carefully can be worthwhile. If you just can't find the leak externally, the leak may be internal from the intake manifold or head gasket. Removing the engine oil filler cap and inspecting the underside of signs of coolant mixing with the oil is a quick way to see if you're on the right diagnostic track.

If you suspect problems with the head gasket, filling the system with coolant and snapping the throttle while the vehicle is idling in park might produce bubbles in the coolant reservoir that would support this theory. (Combustion chamber pressure leaking into the coolant system bypassing the head gasket causes this.) It's important to note that using (distilled) water alone to top up the reservoir is not recommended since it can affect the coolant's freezing point and life expectancy.

Coolant now comes in many colors (there's no standard in the industry yet) and whatever color it is it should be clear and consistent, not murky, muddy or full of sediment (that indicates problems). Whatever type of coolant you use, it always needs to be handled carefully and disposed of properly.

Some antifreeze formulas also are affected by exposure to the air and must be stored in a sealed, clearly marked container and discarded within a week of being opened.

**Problem: Too long to provide heat (Common cause: Thermostat stuck**



**open or plugged heater core – sometimes!):** A thermostat stuck open notoriously causes this problem, and it can be checked quickly by feeling the upper and lower rad hoses to see if they're the same temperature after the vehicle has been running for a few minutes. If both hoses are the same temperature, the thermostat might be stuck open and the coolant (and engine) isn't getting to warm up properly. Note though that this problem tends to develop over time on vehicles with a few miles on them, not suddenly developing on the first cold morning of the year. And, of course, at below freezing temperatures it does take a while for most vehicles to get any heat at all so caution is needed. Too many engines are destroyed because drivers rev up the engines immediately after cold start (without plugging in block heaters) to get the vehicles to heat up more quickly.

A clogged heater core could cause this problem, in which case the engine could be at operating temperature but there's still no heat inside the vehicle. A quick check of the temperature gauge will show if the vehicle has warmed up and if you can safely access the heater core hoses they should be about the same temperature going into and out of the heater core.

This concern can be difficult to diagnose correctly at times because "too long to heat up" varies depending on ambient temperature and the type of vehicle involved. Some vehicles just won't create enough heat to warm up the passenger compartment when it gets extremely cold outside (smaller engines are known for this).

You can, however, check block heater operation (they do fail) and for continuity in the plug in cord, and also check the auxiliary or PTC heater operation if such things are installed on the vehicle. But as anyone who's sat shivering in a compact car in the coldest days of winter can attest, sometimes the system just can't produce enough heat and there's nothing you can do but wait until spring comes.

## Conclusion

If the problem isn't caused by any of these common things, it's smart to look for things like collision damage and any recent work that might affect the system. Problems with the automatic climate control system can often be traced back to recent windshield replacement (sometimes sensors are left disconnected after the repair). Well-intentioned car washing can damage radiator and condenser fins and affect operation, especially if the protective paint coating has been removed and left the metal exposed to the elements.

Quickly check for anything else that doesn't work, especially if it shares a splice or connector with the problem circuit. You can often cut down on diagnosis time by focusing on that part of the circuit. There's no excuse for not properly diagnosing a vehicle but having a few diagnostic tricks up your sleeve and understanding the common causes of problems can reduce your diagnostic time and keep customers happy. *TL*

### VANESSA ATTWELL CONTRIBUTING EDITOR

Vanessa Attwell is a Master Technician for two major manufacturers and has also worked on the bench of an independent shop. She has developed and delivered training for both vehicle manufacturers and independents, and helped develop government training and regulations standards.

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## TECHNOLOGY

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# PREPPING FOR ANOTHER YEAR

## A VISIT TO ORLANDO AND THE ANNUAL MACS CONVENTION

Match the light to the dye for best results in finding those small leaks.

**A**ir conditioning service is something we in the Deep South perform 12 months a year, and sometimes I have to stop and remind myself that the 80°F February day I'm experiencing is not representative of the weather my Northern brethren face. I'm sure it's hard for them to even consider A/C work while they are digging out from several feet of snow. But the annual Mobile Air Conditioning Society (MACS) convention, hosted every February in a generally warm location, gives us all a chance to take a break from the season's challenges and prepare for the time our customers begin complaining about the heat, rather than the cold.

### Snapshots in Time

While not directly tied to A/C repair, Marty Miller of Experian Automotive presented an interesting collection of data on the light truck/passenger car market to attendees. For example, you hear a lot about the average age of cars on the road in the United States, but did you know that factors offset that statistic's value, impacting the number? More important to understand, whether you are in marketing or just

own your own shop, are the Vehicles In Operation (VIO) statistics.

VIOs are "a snapshot in time," according to Miller, the number of vehicles on the road at any given time. Twelve months ago, the U.S. VIO was approximately 245 million, and today it is roughly 251 million. On the surface, it looks like little change, but diving into the factors that make up the number, a different picture is seen. The VIO is made up of existing vehicles plus new car sales, less cars removed from service (scrapped or exported). During the last 12 months, 10.2 million cars were removed from the VIO and 16 million new cars were sold (up from the previous 12 months and almost double the number of new cars sold at the peak of the recession a few years back). Within the VIO, though, are the used car sales, which accounted for a 38 million car change in the make up of the total VIO.

And to get an overall feel for the market's opportunities, it's more important to consider what Miller calls the "aftermarket sweet spot." These are the cars that are 6 to 12 years old and historically, the ones whose owners are investing in more substantial repairs and maintenance. In the U.S., there

currently are 93 million cars and light trucks in the sweet spot, a number that has been on a slight decline during the last few years.

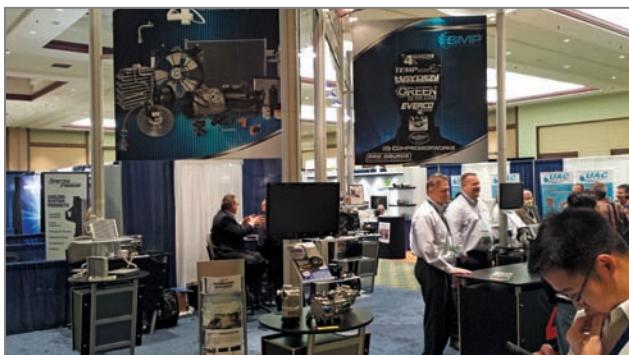
Some other interesting factoids Miller shared are:

- Domestic makes still make up the majority of vehicles in the sweet spot, but that is on the decline.
- Domestic makes still hold the majority of the light truck market, but the imports dominate the passenger car market and their lead is growing.
- Full size pickups lead the VIO with a 15 percent share, while hybrids make up only a 1.3 percent share.
- The Ford F150 is the leader in light trucks, but there actually are more



Experian Automotive's Marty Miller provided attendees with insightful market data at the MACS show in Orlando.

Photos: Pete Meier



**Four Seasons was among the larger exhibitors at the tradeshow.**

GM-made trucks overall when you factor in the GMC and Chevy brands together.

- Six cylinder powerplants are on the decline, 4 cylinders are on the rise and interestingly enough, vehicles with 8 cylinder engines have remained steady during the last several years.
- The big three in America today are Ford, GM and Toyota, with FCA (Chrysler) a close fourth.

### The Trade Show

With classes filling most of Thursday, the main focus on Friday was the trade show. Eighty exhibitors were on hand, showcasing a variety of products and services, including the little things that techs should know that could make the difference between an easy repair and a difficult one.

Leak detection is one. With today's systems running smaller charges than ever, even small leaks quickly can deplete a system to the point it is not keeping the customer cool. Failure to find and repair these small leaks can result in a customer comeback at the least, and possible system damage at the worst. And if you are like many techs, the tool of choice for leak detection is fluorescent dye.

Now, I've been using dye for years to locate leaks in a variety of systems, not just A/C, and as I wandered the exhibits, I saw the usual collection of dye makers displaying their wares. As I passed the Brighter Solutions booth, though, I noticed that three small lights, all apparently the same at first, on the table and I had to stop and take a closer look. I learned that the lights were, indeed, different. The light wavelengths were the distinguishing feature, and I discovered that, for optimum fluorescence, the light should be matched to the dye. One specifically designed for A/C use caused the mated dye to glow as if it had an inner light, while the same dye illuminated by the lamp with the lowest wavelength only caused the dye to glow dimly in the same light. It, however, was more effective when mated with dye additives used for engine oil or transmission fluid leaks. All these years in the business and I thought it was a one size fits all deal!

Stopping by the Tracer Products booth a bit later, I confirmed what I had just learned from their product specialists. But on display was a tool I had some familiarity with but never had seen offered by this particular company. It was an ultrasonic leak detection kit, similar in concept to the Steelman Tools product on which I produced an episode of The Trainer in August 2014. The Tracer Products reps at

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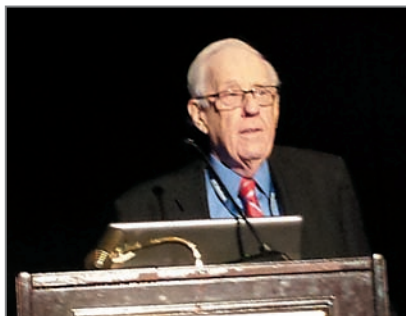
**PHILIPS**

the booth and I talked about the variety of uses such a tool could be applied to, including looking for A/C leaks, simply by listening for the “hiss” of escaping refrigerant.

Also on display were new Recovery, Recycle and Recharge (RRR) machines, including the new ACX-series of

machines from MAHLE Aftermarket. The two models on display included one dedicated to servicing the new refrigerant, R1234yf, and the differences between the two were noteworthy. Due to the nature of R1234yf, the specifications for the machine include ventilation of the cabinet to prevent any build-up of refrigerant that might occur should there be a small leak internally and a built-in refrigerant identifier to prevent the machine (and its charge of expensive gas) to become contaminated.

With the EPA proposing a phase down of R134a (in new vehicles by the 2021 model year), it's only a matter of time before shops will need to add these new machines to their inventory. The question now that shop owners have to answer is when that time happens for them individually. I know there still are questions on the future of refrigerants in the United States and the answers we seek we on Saturday, when Ward Atkinson delivered his “State of the Industry” presentation.



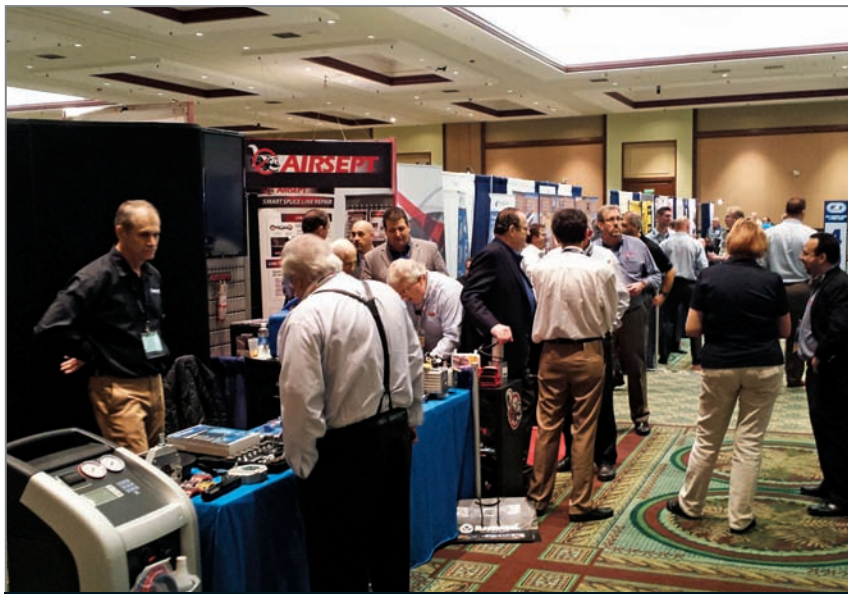
A highlight of the MACS show is Ward Atkinson's State of the Industry presentation.



Among the products on display at the MACS tradeshow were the new MAHLE ACX-series service machines for R134a and R1234yf.

## State of the A/C Industry

Formal training sessions were on hold Friday so that everyone could have the opportunity to walk the trade show. This also allowed the trainers, such as John Thornton, Standard Motor Products' Ryan Kooiman and Dephi's Dave Hobbs, who led classes on Thursday to take a break and prepare for their Saturday sessions. Even though the MACS event focuses on the mobile air conditioning



Eighty exhibitors were on hand for this year's MACS tradeshow.



Sound is gaining ground as a diagnostic tool, as this Tracer Products offering on display at the show attested to.

and heating sector, their training offerings are well-rounded, meeting the needs of their members in both the light duty and heavy duty markets. Classes covered reprogramming and diagnosing network communications problems in addition to several offered on core topics like diagnosing variable displacement compressors and system airflow issues.

For many, though, the star attraction every year the presentation Ward Atkinson, former chair of the SAE Interior Climate Control Committee, makes. This year's presentation started with highlights on the EPA's proposed rule to phase down the use of R134a in the United States.

First, this is a phase down, meaning that during the next several years we will see R134a being replaced as the refrigerant of choice in new model cars with the goal of full transition by model year 2021. Unlike the R12 days, there is no plan to retrofit current R134a cars to a replacement gas, and Atkinson assured his listeners that there would be plenty of R134a around to continue servicing these systems for many years to come.

"From prior MACS surveys and other data, less than 10 percent of the R12 fleet was ever retrofitted," Atkinson said. "Believe me, you will not retrofit the R134a cars with the new refrigerants."

You may remember that this all started with a ruling in the European Union requiring new vehicle platforms to use a refrigerant with a Global Warming Potential (GWP) rating less than 150. That spelled the end of R134a, and the selection of a suitable replacement is still a matter of debate, with R1234yf the favored choice for now. Here in the United States, there is no such magic

number, and any refrigerant on the approved list is a potential candidate as a R134a replacement. R1234yf certainly is at the top of that list, but other potential refrigerants we might see in use include R744 (carbon dioxide), R445a (a blend refrigerant containing 6 percent R744, 9 percent R134a and 85 percent R1234ze) and R152a (a flammable gas we thought had been taken off the table years ago).

Atkinson also cautioned attendees to be aware of imported R134a that does not meet the SAE purity standards, J2776. Refrigerant suppliers that do will have that stamped on both the container and the shipping container and sticking to these suppliers will ensure the quality of the gas you're installing in your customer's car. While the imported refrigerant is cheaper, it might contain contaminants you're refrigerant identifier won't pick up.

Another topic of concern he shared was that of an advertised "environmentally friendly" alternative to R134a that recently appeared in the market. Atkinson said, "Let's not be fooled folks. You go get an MSDS (Material Safety Data Sheet) on it and it doesn't tell you what it is, but it's similar to the stuff you use in your barbeque (grill)."

He further explained that this is a hydrocarbon refrigerant (meaning it is highly flammable) and automotive systems are not designed to use it. "If you decide to install these (refrigerants) into your customers' cars, you could be setting yourself up for a big liability issue."

It makes the case for adding a refrigerant identifier to your shop if you don't already own one. You never know if the car you're working on has been contaminated by a DIYer or another shop.

Atkinson then talked about service concerns facing the industry as new technologies and system strategies were being introduced. For example, many newer cars automatically enter "recirculation" mode when the ambi-

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ent temperature goes higher than 75°F. How many control units do you think will be replaced in attempts by untrained technicians who think this is a fault and not a design feature?

"Basically we have lots of bells and whistles on these new cars that are going to be doing all kinds of things," commented Atkinson, adding that recommendations were made encouraging the SAE committee to consider standards for the proper diagnosis and repair of these systems. *MA*

PETE MEIER  
TECHNICAL EDITOR

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

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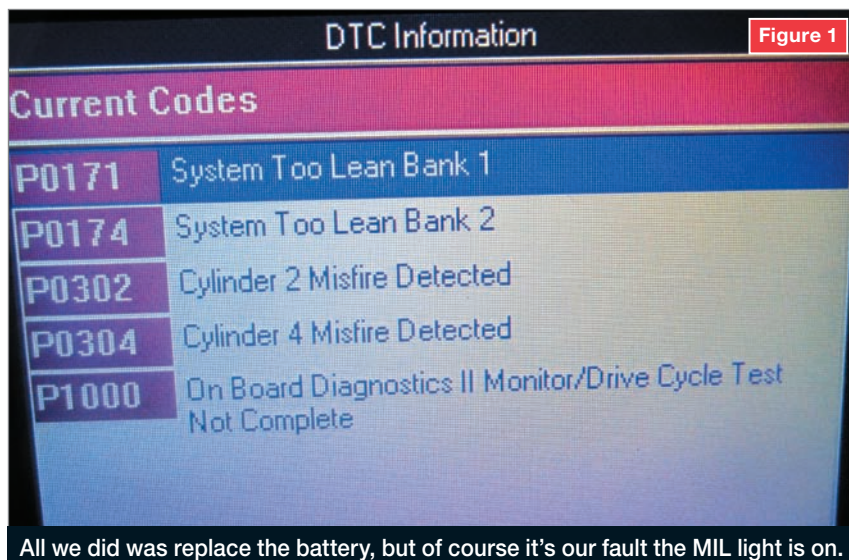
BY **G. JERRY TRUGLIA** |  
CONTRIBUTING EDITOR

**T**his problem vehicle was a 2005 Ford Crown Victoria 4.6L V8 with a complaint of sometimes being hard to start. The retired owner of this Ford does not drive it much. In fact, this vehicle had only 25,000 miles on the clock. The first test that we performed was the standard load test on the battery where we programmed half of the Cold Cranking Amps (CCA) in to our load tester. If the battery is good, the voltage should not go below 9.6 volts.

This battery failed the test big time, with the voltage dropping to 8.1 volts. Next, we charged the battery in order to perform a starter and alternator test so we could rule out those components as a cause of the battery's failure. The testing found that the starter and alternator were good, so it looked like a simple fix requiring only a replacement battery.

A few weeks after we performed the service, we received a call that the Check Engine light was now illuminated on this Crown Vic. As I'm sure you've experienced, the owner was thinking that we had something to do with his bright glowing Malfunction Indicator Lamp (MIL). All we did was install a new battery, but as the saying goes, "Once you touch it, you own it!" We had the customer bring the vehicle in so we could check it out and see what caused the MIL to come on.

After hooking up our scan tool, we found the PCM had stored the following Diagnostic Trouble Codes (DTCs): P0171, P0174, P0302, P0304 and P1000



(Figure 1). With two DTCs indicating system lean problems (P0171/P0174), the two misfire DTCs (P0302/P0304) could be a result of the engine's lean condition. We knew we had something that was affecting both banks, because both lean DTCs were present. After checking the data stream, we found what we were looking for. Both Short (STFT) and Long Term Fuel Trim (LTFT) values were way out. Because the data stream confirmed the P0171/P0174 DTCs, we knew we had to concentrate on something that was causing both banks to run lean.

Let's review what can cause such high LTFT numbers. Now, stop believing everything you read on the Internet and don't make the awful mistake of thinking that all Fords have problems with their Mass Air Flow (MAF) sensors. While it is a common pattern failure on older Fords, always remember to test

and confirm before condemning a part. We know many techs have encountered a bunch of bad Ford MAF sensors, but I'm sorry to say that you would be dead wrong condemning this one.

The MAF checked out OK, so what next? How about a major vacuum leak? Would that affect both banks? Maybe, but once again that was not the cause of this problem. Our next step was to go with something that can also affect both banks — fuel delivery.

A fuel delivery problem can be a result of voltage drop in the fuel pump circuit, a clogged fuel filter or other restriction to fuel flow, a bad fuel pump or a failed pressure regulator allowing fuel to dump back to the tank.

Narrowing down this fuel trim problem was not going to be hard. We were going to use a very simple test called current ramping. We perform this test by using an amp clamp and labscope on

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the fuel pump circuit. Why should we current ramp? First, it's the quickest way to see how a fuel pump is running and second, it's the easiest way to see how a fuel pump is running.

We need to know where to connect the amp clamp. Going to the fuel pump wires would work, but they usually are buried. The best option is to locate the fuel pump relay circuit. If there is something else in the circuit that the relay controls, like ignition or injectors, then go directly to the power or ground wire for the fuel pump and clamp at that point. In most cases, you can use a suitable fused jumper wire and connect it to pin 30 and pin 87 (in the fuse box) or to the fuel pump fuse (Figure 2). Just make sure that there is nothing else powered on this circuit except the fuel pump.

Now that you have located the correct source to the fuel pump, you should set up your equipment properly to get the best possible waveform. First let's take a look at how to set up the most common amp clamps.

Make sure the 9 volt battery in the amp clamp is good. Select 100 mV/A. This is the best setting to use for the finest resolution on your labscope. Connect your amp clamp to your scope and zero it. Next, select 100 mV per division or 1 V per screen on your labscope.

How to tell if the waveform is good or bad is not that hard, especially if you can compare the signal to a known good one. It's a great idea to save waveforms on good running vehicles for comparison in the future. If the amperage was below normal, it could indicate that we have a voltage drop in the circuit or a bad pump; if the circuit has normal or above amperage, that would rule out a voltage drop problem.

Look at the OTC/MAC Tools labscope in Figure 3 and count the vertical lines. Note that the labscope is set to 0.1V (100 mV) and starts its counting amperage up at the A (look at the lower left corner above the SAVE RECALL). The A is where zero amps starts and each vertical line above it equals one amp. Make sure to go to the top peaks of the waveform in order to come up with the correct amperage reading.

The labscope is displaying 7 amps on this vehicle's fuel pump, which is higher than what the reading should be. The reading could indicate a bad fuel pump due to the armature binding or a

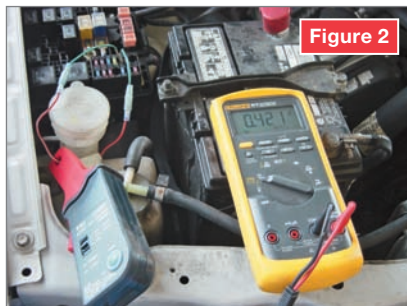


Figure 2

The amp clamp can be placed anywhere in the circuit and pump current measured with a meter or a scope.



Figure 3

The scope has an advantage over the meter, though. It provides clues to the health of the fuel delivery system the meter doesn't.

restriction in the fuel system. I always like checking the easiest and cheapest component first and in this case that's the fuel filter.

We replaced the fuel filter and rechecked our current reading. The amperage of the fuel pump was down to 5.5 amps, a more normal range for this car. Afterward, we cleared the DTCs and reset the Keep Alive Memory (KAM), performed a test drive and took another look at the STFT and LTFT data PIDs. With the restriction removed, and fuel volume restored, the system lean and misfire issues disappeared. *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.

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# WE WON'T BE FOOLED AGAIN (HOPEFULLY)

THE JOBS THAT TEACH US THE MOST TYPICALLY ARE THE ONES THAT SMACK US AROUND.

BY RICHARD MCCUUSTIAN | CONTRIBUTING EDITOR

Everybody who does vehicle inspections has to advise the customer what needs doing right away and what can be put off for a while, and those inspections need to be thorough. At the Ford dealer, we did a 29-point inspection on every vehicle, and a technician with integrity will take those inspections seriously. On vehicles that obviously have to be trusted to keep people safe, these inspections are about a lot more than an upsell. In some cases, if we don't take the inspection seriously, we can miss something really important that can range from embarrassing to downright deadly.

Embarrassing would be the time when a young technician I knew replaced a taillight fuse, checked off all the boxes on the inspection sheet and

never opened the hood. When the car had to be jumped on the service lot a few hours later because he left the park lights on, it turned out that a squirrel had built a nest on top of the battery. The word "busted" comes to mind.

Another time we checked a 2010 Ford Fusion a young woman had purchased at a GM dealer, which supposedly does inspections and "certifies" all of its used cars. She heard noises under the front end during turns and went back to the GM dealer where she bought the car, only to be blown off by the service manager. He told her they didn't work on Fords at the GM dealer and she needed to have it checked at a Ford dealership or an independent shop. When she brought the car to us, we found that the right hand inner lower control arm bolt was unscrewed totally and was making its way out of place a little at a time. Almost half the length of the bolt was visible, and it wasn't hard to spot. Can you imagine what kind of disaster she would have faced had that bolt come all the way out at 70 mph on a busy highway?

One thing I preach to my students is that if something bad happens to the person driving a vehicle they

inspected that can be traced to their negligence during an inspection, the potential is there for things to get really nasty. Insurance investigators love that kind of thing.

Studies in the 1980s proved that vehicles equipped with a center high mount stop lamp were 40 percent less likely to be rear-ended by another vehicle in stop-and-go traffic, thus third brake lights eventually became the order of things for cars, trucks and vans. With that as the base line, I explain that missing something as simple as an inoperative light makes it 40 percent more likely that the person driving that car will have another vehicle crash into them from the rear.

Failing to check the final drive lubricant on a Toyota Camry or Corolla is another deadly but often-missed inspection point. That final drive isn't lubed by the auto trans fluid on those transaxles, and if the CV axle seals are leaking so that the differential oil is gone, those gears can (and will) lock up while driving down the highway. If somebody had you prep their vehicle for a long trip, you might find some really smelly egg all over your face the next time you hear from them.



## DODGING LEAKS

### 2004 DODGE DAKOTA

Vehicle Year/Make/Model

142,654

Mileage

3.7L V6

Engine

42RLE

Transmission

### OIL LEAK FROM CYLINDER HEAD

Vehicle Complaint

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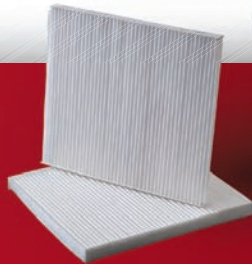


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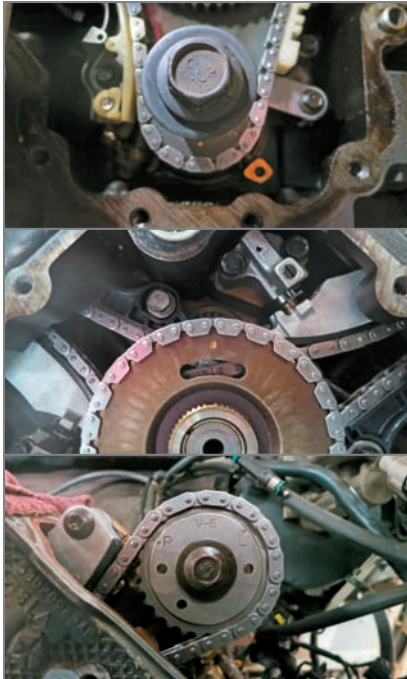
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Here's the engine in time. We opted not to use the new jackshaft gear (center) because there was nothing wrong with the original. But even with the engine in time, valves were bent because the rocker arms were in place during the torquing of the head and valves were open that didn't need to be.

## Finding the Problem

This month's story revolves around a Dodge Dakota that had developed an oil leak between the passenger side cylinder head and the engine block, and the driver of the vehicle picked it up as an oil smell. Overhead cam engines like this one have a pressurized oil feed passing through the head gasket, thus the potential for a pressure leak exists.

Our inspection revealed oil seepage that was wet enough to make its way back to the exhaust manifold right above the header pipe. We know that can be a fire hazard, particularly in the heat-soaked subtropical summers we have here when manifold heat can burst liquid oil into flame. There was no valve cover oil leak from above the cylinder head/block joint on this first diagnosis, and the exhaust was cooking the oil before it ever dropped to the ground, thus the driver smelled but did not see the leak. How likely it was to catch fire isn't as pertinent as what could happen if it did.

This oil leak wouldn't be a cheap fix



This was the engine running with the timing cover off – kind of messy, but it pinpointed the bouncing tensioner you see here on the left. We installed the old tensioner because the new one was damaged by running with no oil pressure cushion.



This valve keeper stuck to the 5.3L Chevy's drain plug was somewhat disquieting. Was it worth pulling a valve cover? Not to the customer.



I would have sworn this bearing and/or the axle were bad while test driving, but the ChassisEar<sup>®</sup> put us to looking elsewhere. When I spun the left front tire, I saw the telltale tread wobble of a bad tire. A new left front tire took care of the noise.

either. You don't just yank the heads off a Dodge 3.7L, pop some new gaskets in place and then sew everything back up. Thanks to the wonderful world of overhead chain-driven cams, this baby would be a big-ticket fix. The timing chain set alone was almost \$500. The green light came, the parts

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were ordered and my student Bobby plowed into the job with zeal. He had the timing cover, intake and valve covers off pretty quickly, and I explained that it's sensible to pop those roller rocker arms out of there so the cams won't be hard to turn and the valves all will be closed. He did pop them out of both heads when he replaced the valve stem seals. He disassembled the timing chains and took the heads off with those rockers in place, cleaned everything and started his reassembly. After I had told him the rocker arms needed to be left on the bench while he was installing the heads and timing the engine, I later noticed that he had left the rocker arms out of the driver side head but had installed them in the passenger side head, which was an idea.

When he torqued the head, it turned out that since the rocker arms were in place, there were valves touching pistons, and when he finished assembling everything, the engine started, ran for about 20 seconds, started making a noise in the timing chain area and then died, a set of circumstances that gives just about any technician an instant sick feeling. If that wasn't enough, when we checked the oil, coolant had made its way into the crankcase somehow, and so the head needed to come back off. More about that in a minute.

### Finding Other Things

Some things we find in the course of normal service tend to give us pause and make us wonder what the heck they mean. For example, one customer brought a 2002 Chevy Silverado to us for an oil change, a U-Joint and some brake work. That particular engine had an oil drain plug with a magnet on the tip of it, and when we removed the drain plug, a valve keeper was clinging to the magnet. What, exactly should we do with this information? Did it pick up a valve keeper from the previous oil changer's bench that he or she didn't spot when the plug was reinstalled? The keeper looked a bit small to have come from that 5.3L, so we told her about it and continued with business as usual.

Then there was my aunt's 1992 Crown Victoria, which had developed a roaring road noise that changed from silent to louder during swerving maneuvers. I swore it was an axle bearing until



This exhaust noise was coming from the cracked catalyst, but we at first swore it was originating in the intake area (top). When we removed the manifold heat shield, we found that the noise was coming from a totally different place. Note the large aluminum brace that helped telegraph the noise. The welding department fixed the crack. This cat costs about \$500.

we jerked the differential cover and pulled the axles; both bearings were pristine, as were the axle surfaces. That one turned out to be a bad left front tire – you could spin it and see the tread wobble. Of course, we didn't look in the front until the ChassisEar<sup>®</sup> alerted us to the fact that there was no unusual noise in the rear. Who knows why the rumble from a bad left front tire sounded so much like it was coming from the rear. It was a great experience for the guys who saw that happen. Early on, we did find a rough rear U-Joint on that one and we replaced it, but we knew going in that what we were hearing wasn't a U-Joint.

Speaking of noises that telegraph, we burned some time chasing an

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annoying exhaust leak noise on a 2008 Altima that sounded like it was coming from up in the passenger side intake manifold area. The exhaust is a long way from the place where we were picking up the sound (we used a stethoscope with its probe removed as a listening pipe). Another student, Melissa, decided to remove the exhaust heat shield, and she managed to short the alternator out and blow the main fuse at the battery (\$26 from Nissan).

But she did use the stethoscope to find that the catalyst was leaking from a crack on the top rear of the cat's case. The heat shield had funneled that exhaust noise up under the big cast aluminum brace that covers the passenger side of the engine to the intake area, and it had projected the noise to that thus our initial belief that the noise was originating in that area. A replacement cat alone would cost more than you'd pay for some used cars here in South Alabama, and so we removed the cat/manifold assembly and carried it to the welding department, where they did a factory-perfect job of sealing the crack.

### Off With its Head

Bobby got the head off the Dodge to find that he had bent three intake valves, and so I ordered three brand new \$16 valves, lapped them in, checked the seats with Prussian Blue, put the head back on with another new gasket and sewed it all back up. The coolant had made its way into the crankcase because one of those intake valves was touching a piston and prevented proper torque on the gasket. I also preach about blowing the liquid out of all the cylinder head bolt holes before reassembly.

When we started the Dodge again with new oil and new coolant, that passenger side timing chain still was throwing a rattling fit. We yanked the cover off and started the engine with the chains exposed, and the tensioner was bouncing (its ratchet mechanism can't take the pressure alone) like there was no oil feeding it. When Bobby took that tensioner back off, a thin piece of foil fell from the back side of the tensioner and the mystery was solved. Apparently the foil had fallen from the other two tensioners on the first install. The problem was that the new tension-



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er had held onto its foil too long and had been damaged by the trauma; it acted the same way even when reinstalled without the foil and fed with oil, so we reinstalled the original tensioner for that side and things got nice and quiet.

We ran the 3.7L for a while and then noticed we still had an oil leak on that side, so we poured in some dye and re-drove it. We found that the passenger side valve cover gasket — brand new — was leaking between the gasket and the head. With the valve cover once again removed, I noticed the sealing surface was clean and shiny and the gasket wasn't damaged, but another new valve cover gasket did the trick.

Bobby now knows 3.7L Dodge timing chains inside out, and I imagine the next time he does one he'll beat book time hands down. That's one of the benefits of having to do and then re-do a job where mistakes were made. He won't make those same mistakes again. *TM*



**RICHARD MCCUISTIAN**  
CONTRIBUTING  
EDITOR

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

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BorgWarner Emissions Systems is producing multi-spark ignition coils for Daimler's six- and eight-cylinder engines. With displacements between 3.5 and 5.5 liters and power ratings ranging from 249 to 549 hp, these powerful engines are available in the Mercedes-Benz C-, E- and S-Classes. Specially designed for gasoline direct-injection (GDI) engines running stratified combustion, BorgWarner's compact multi-spark ignition coil technology enlarges the ignition zone for more controlled and optimized combustion, improved fuel economy and reduced emissions, the company says. Based on a conventional 14-volt coil, BorgWarner's multi-spark ignition coil features a bidirectional interface with an electronic control unit to precisely trigger multiple discharges and recharges within one millisecond to produce spark energy multiple times at short intervals. Enlarging the ignition zone and generating multiple sparks extends the spark duration considerably to deliver optimal combustion, improved fuel economy, lower emissions and prevent misfires.

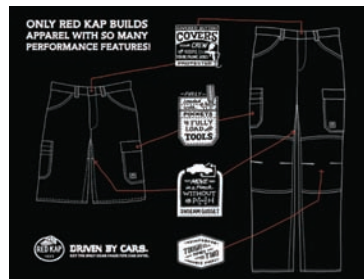
For more information, visit [www.borgwarner.com](http://www.borgwarner.com). BorgWarner

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For more information, visit [www.redkap.com](http://www.redkap.com).

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EnerSys has expanded its ODYSSEY Performance Series battery product offering to include the Group 75/86 battery designed for a wide range of consumer passenger vehicles, custom and classic cars and SUVs. The ODYSSEY Performance Series 75/86-705 battery features 708 cold cranking amps (CCA), 89 reserve capacity (RC) minutes and weighs 43.4 pounds. Engineered with Thin Plate Pure Lead (TPPL) technology, ODYSSEY Performance Series batteries feature dry cell Absorbed Glass Mat (AGM) technology to contain acid and prevent spills, allowing the battery to be installed in almost any position, the manufacturer states. ODYSSEY Performance Series batteries offer a three- to 10-year service life and two-year storage life at 77 degrees Fahrenheit (25 degrees Celsius). They are vibration resistant, classified as "non-spillable" by the U.S. Department of Transportation and include a limited four-year full replacement warranty.

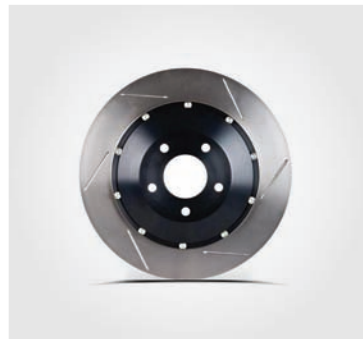
For more information, visit [www.enersys.com](http://www.enersys.com). EnerSys Corp.

### DIRECT REPLACEMENT ROTORS

Centric Parts has introduced a range of StopTech two-piece AeroRotor Replacement Kits (ARK) for the 2012-2014 Ford Focus ST. The new direct replacement rotors are available for front axles and include lighter-than-stock, pre-assembled StopTech two-piece, floating, directional AeroRotors with iron friction rings and aluminum AeroHats. Available in drilled or slotted form, with or without a protective zinc coating, these new StopTech rotor upgrades expand Centric's offerings for the Ford Focus ST, which already include replacement and upgrade rotors, lines, pads, calipers and more, the company reports.

For more information, visit [www.centricparts.com](http://www.centricparts.com).

Centric Parts



## LED FLASHLIGHT

Tracer Products has introduced the Tracerline Vio-Blu — a cordless, dual-head LED flashlight that is ideal for locating all automotive system leaks. The Vio-Blu features a high-output True UV LED at one end and a super-bright blue light LED at the other, the manufacturer states. As a result, it provides optimal fluorescent response and contrast, regardless of the type of dye. The True UV LED fluoresces all Tracerline® universal/ester and PAG A/C dyes, as well as TP-3400, TP-3405, TP-3900 and TP-3940 fluid dyes. Leaks can be seen even without using the yellow glasses provided. The blue light LED works with all oil-based dyes, including difficult-to-fluoresce yellow dyes.



[www.tracerline.com](http://www.tracerline.com) Tracer Products

## TIRE CHANGER

Hennessy Industries, Inc. has added the ProGuard Plus Leverless tire changer. The ProGuard Plus Leverless tire changer is an advanced version of Coats' current ProGuard tire changer that is designed to tackle the most advanced applications in the industry. In addition to leverless operation, the Coats ProGuard Plus Leverless tire changer comes fully equipped with a Pneumatic Wheel Clamping System, which the company says is faster and easier to use than manual systems and provides more reliable and

consistent clamping force to prevent slippage. Other features include a Dual-Bead Roller System: Coats added a bottom roller to the bead-roller system to increase productivity by making the unit match-mount-capable and increasing changing speed and capability; Semi-Automatic Top Roller Indexing: Allows for faster bead dislodgement without risk of wheel marring, and automatically clears rim flange without prompting or actuation, making the bead-loosening operation faster and much less prone to wheel contact; Auxiliary Bead Depressor: An assist tool that locks into the tower assembly to help keep the bead in the drop center without coming into contact with the face or the spokes of the rim; Robo-Arm®: This powered assist device is critical for mounting run-flat and low-profile tires. It effortlessly keeps the top bead in the drop center while servicing the toughest applications; and Built-in Adjustable Wheel Lift: Controlled through an easy-to-reach pedal, the automated wheel lift eliminates the strenuous process of manually placing heavy tire and wheel assemblies on the pedestal.



[www.coatsreveal.com](http://www.coatsreveal.com) Hennessy Industries Inc.

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K-Tool International offers the KT173630 heavy-duty aluminum cap style filter wrench, 64.5mm and 14 flutes. It's to be used with a 3/8-inch square drive. It works on several Toyota and Lexus applications including Toyota Avalon 05-08, Camry 07-09, RAV4 06-08, Sienna 07-08 3.5L, Tundra; 07-08 5.7L, Corolla, Matrix 09-10, Scion XD 08-10, Truck 07-10; Lexus GS, IS, LS 06-10, ES, RX 07-10; and the Honda Filter No. 15400-PLM-A02 and Nissan Filter No. 15208 65FOC, the company states. The cap style oil filter wrench has a lifetime warranty.



[www.ktoolinternational.com](http://www.ktoolinternational.com) K-Tool International

## FOUR-POST VEHICLE LIFTS

Rotary Lift is expanding its Shockwave-equipped line of vehicle lifts to include four-post models, providing substantial time savings and improved productivity for quick service technicians. The company's Shockwave technology is now available on 14,000-pound capacity SM series and AR series four-post lifts. Rotary Lift's versatile 14,000-pound capacity SM and AR series four-post lifts can handle cars, vans and light trucks through Class 3. With Shockwave, the lifts can reach full lifting height in just 35 seconds, the company says. Descent takes only 18 seconds, meaning a Shockwave-equipped four-post lift can be raised and lowered in less than the time it would take a standard four-post lift just to raise a vehicle. This allows technicians to complete more jobs



each day, which puts more money in their pockets and increases shop profitability. Shockwave's speed is made possible in part by its DC power unit. The batteries are kept charged by an onboard charger, so the lifts will work even if the shop's electricity goes out. Since the charger runs on a standard 110V power connection, there is no need to install expensive 220V wiring for the lift. On Rotary Lift's 14,000-pound capacity four-post lifts, the Shockwave power unit can be mounted to either the front or side of one of the columns to meet the space needs of any work bay.

[www.rotarylift.com](http://www.rotarylift.com) Rotary Lift

## JACK/DOLLY

GoJAK combines a foot-operated mechanical jack with a car dolly, all in a single unit. GoJAKs lift and move vehicles at any angle, anywhere, without power. Zendex Tool Corporation has recently improved the load capacity and employed new casters for several of its GoJak models. Model 4520 replaces the Model 4500, both of which were developed for the racing industry. Model 4520 handles tires as wide as 20 inches and up to 36 inches tall, with weight capacity to 1,125 pounds each wheel (up to 4,500 pounds with 4 units). Model 5211 replaces the Model 5000 as the workhorse of the line. It is designed for tires as wide as 11 inches and up to 34 inches tall, with weight to 1,300 pounds each (up to 5,200 pounds with four units). Model 6313, the ox of the line, accommodates tires as wide as 13 inches and up to 36 inches tall, with weight to 1,574 pounds each (up to 6,300 pounds with four units). GoJak accessories include wall and tow truck mounting brackets and weather protection covers, according to the company.



[www.gojak.us](http://www.gojak.us) Zendex Tool Corporation

## LIFT SYSTEM

MaxTrac Suspension has a new lift system that clears 35-inch tires on 2002-2008 Ram HD 2500/3500 2WD trucks. The kit combines MaxTrac 3.5-inch-lift one-piece ductile iron spindles with engine-specific front coil springs to achieve about 6 inches of total lift. Also included are DOT-approved braided steel front brake lines, fabricated-steel rear leveling blocks, rear MaxTrac twin-tube shocks, mounting hardware and instructions, the company reports. All components are covered by a limited lifetime warranty. The kit fits both single rear wheel and dually models.



[www.maxtracsuspension.com](http://www.maxtracsuspension.com) MaxTrac Suspension

## AUTOMOTIVE PRODUCTS GUIDE

### CARQUEST RADIATORS

Advance Professional Driven by Carquest offers national-brand quality Carquest radiators, which meet or exceed OE specifications and feature a limited lifetime warranty. Carquest radiators cover approximately 96 percent of foreign and domestic cars and light duty trucks on the road today. For more information on quality Carquest products, call your local Advance delivery location.



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Federated Auto Parts has developed an addition to its friction offering with a new co-label line developed and supplied by Wagner Brake. The new product line is a premium offering designed for professionals that was exclusively designed for Federated members and their customers. The line uses the highest performing formulas specific to each application and includes System Synergy Technology (SST), which is an OE approach to brake design that ensures the interaction of all brake components to provide the ultimate performance.



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Ranger Products announces its high-powered RP-20FC Oil Filter Crusher. In just 20 seconds, this industrial-quality, welded steel plate crusher applies an impressive 10 tons of pure, air-operated pressure to just about any used oil filter, easily reducing it to 25 percent of its original size and removing 95 percent of the oil. The exclusive X-shape bevel in the press head pre-aligns filters for an absolute vertical press, so even the popular 8-inch tall filters for Cummins and PowerStroke diesel-powered vehicles fold beneath its massive force.



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SKF has developed a cost-effective front-wheel hub solution for the 2013-2008 Mercedes Smart Car. Designed as a front-wheel hub only, part number BR930861K includes three precision-machined pins that make it easy for an installer to press the hub unit into the knuckle assembly without having to replace the knuckle itself.



SKF

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# THE NAGGING TPMS LIGHT

WHAT TO DO WHEN THE LIGHT IS ON (AND CUSTOMERS SAY IT WASN'T BEFORE).

BY **PETE MEIER**  
**Technical Editor**

"That light wasn't on when I got here!"

Your customer is adamant that the funny looking yellow warning light now brightly illuminated on the instrument panel was not on when he or she brought the car in. You know, the one that looks like a tire cutaway with an exclamation point in the middle of it? That's the warning light for the Tire Pressure Monitoring System (TPMS), and if you've recently performed some type of tire-related service or repair, odds are you forgot to tell the TPMS controller that you made some changes.

The first TPMS systems were a bit more forgiving than their more modern cousins, relying on existing Antilock Braking System (ABS) sensors to monitor tire pressure. These early systems inferred the tire pressure by plugging wheel speed data into a complex algorithm to monitor tire circumference. A low tire has a smaller circumference and will rotate faster than a properly inflated tire of the same type and size. These systems had to be placed in a "learn" mode whenever tire rotations or replacements were performed. Tire pressures would be corrected and then the vehicle would be driven in order for the system to establish an accurate baseline.

More common today, though, are systems using pressure sensors (mounted by band to the wheel or as



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a part of the tire valve stem assembly). On many cars and light trucks, the sensors are assigned to a specific wheel position. Rotating the tires without relearning the sensor positions will result in incorrect displays and could cloud troubleshooting efforts if the TPMS warning illuminates for a valid reason. Imaging trying to find a leak in the wrong tire.

In this edition of The Trainer, we'll show you how to make sure you don't have TPMS warning light comebacks, how to identify a vehicle with a TPMS system, and how to troubleshoot an illuminated TPMS warning light.

The Trainer is our monthly how-to video series, aimed at educating technicians of all levels on a variety of topics.

Also, you can find more training like this at Automechanika Chicago. Visit [MotorAge.com/AMCregistration](http://MotorAge.com/AMCregistration) to sign up for the free training event. [ZZ](#)

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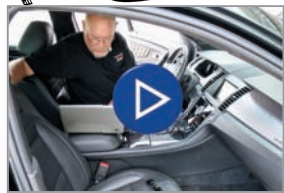
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