ADVERTISEMENT

Motor Age®

ADVANCING THE AUTOMOTIVE SERVICE PROFESSIONAL | www.SearchAutoParts.com

JULY 2013

Motor Age®

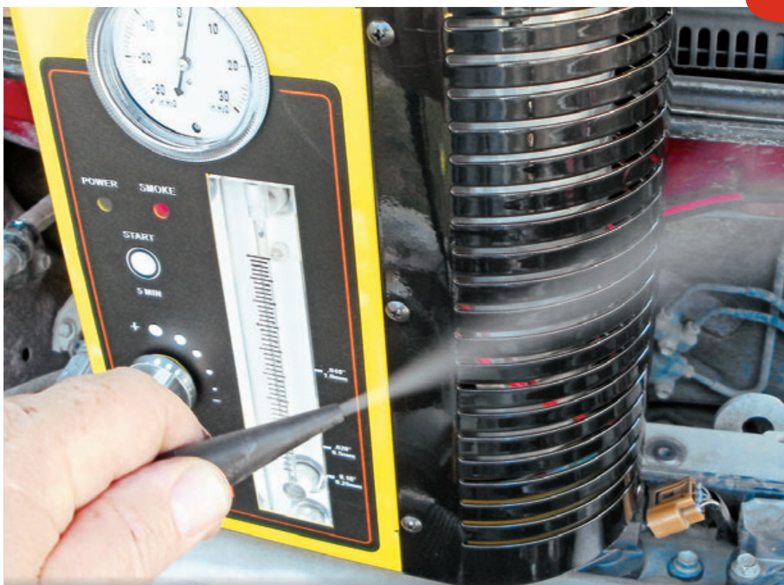
Advancing the Automotive Service Professional Since 1899

July 2013

Vol. 132, No. 7

Talk shop anytime

AUTOPRO WORKSHOP



NOW YOU SEE IT, NOW YOU DON'T.

SHOULD YOU BE LISTENING TO YOUR EMPLOYEES?

COMMUNITY

KEEPING UP WITH TODAY'S TECHNOLOGY

What does your shop really need to stay ahead of the game on the Internet?

PRODUCTS

TOOLS AND PARTS FOR THE SHOP

Following up last month's largest listing, we have more new options to better business.

OPERATIONS

WORKER'S COMPENSATION EDUCATION

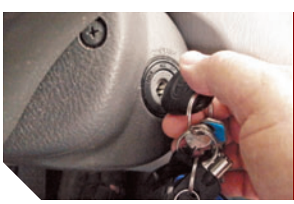
Protecting your technicians and other staff means learning the rules and teaching safety.

ADVANSTAR AUTO

TRENDING

WHAT SHOPS WANT

Owners take advantage of a targeted audience at GAAS 2013 to share their needs.



TECHNOLOGY

GETTING STARTED ON NO START COMPLAINTS

Tips on making an 'easy' problem to fix even easier.

ONLINE EXCLUSIVE

NEED HOW-TO TRAINING?

Check out our growing archive of training videos.

JUST SCAN IT

Scan here for your direct link to motorage.com

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

July 2013 Vol. 132, No. 7

Talk shop anytime

AUTOPRO WORKSHOP

Motor Age

COMMUNITY

ONLINE COVERAGE

Motor Age TRAINING
Self-Study Guides for ASE Certification

Upcoming Webinars & Archives
We have two webinars coming up in August. Register now to save the dates.
MotorAge.com/webinars

POWERTRAIN PRO
Read new technical content for general repair and specialty shops.
MotorAge.com/POWERTRAINPRO

Motor Age AFTER HOURS
Pete Meier has hours of videos to help train today's technicians on products & processes.
MotorAge.com/AfterHours

ONLINE VIDEO KNOW-HOW
MotorAge.com/video

JUST SCAN IT
WATCH THE TRAINER ON YOUR MOBILE PHONE!

The Trainer video series
Does a catalytic converter code really mean there is a cat failure?
MotorAge.com/july13trainer

SOFTWARE DEMO
/esinspect

BOOST SHOP REVENUE
/growrevenue

FOLLOW US!
Check out new tech tips every day on our social networks!
Twitter: *@pete_meier, @Motor_Age, @ATSGcompany*
Facebook: *Pete Meier, Tschanen Brandyberry*
Workshop: *Peter, CarGirl, BWrench, jatonymartin and more!*

TECHNOLOGY

POWERTRAIN PRO

Chief Executive Officer
Joe Loggia

Chief Executive Officer Fashion Group, Executive Vice-President
Tom Florio

Executive Vice-President, Chief Administrative Officer & Chief Financial Officer
Tom Ehardt

Executive Vice-President
Georgiann DeCenzo

Executive Vice-President
Chris DeMoulin

Executive Vice-President
Ron Wall

Executive Vice-President, Business Systems
Rebecca Evangelou

Sr Vice-President
Tracy Harris

Vice-President, Media Operations
Francis Heid

Vice-President, Legal
Michael Bernstein

Vice-President, Electronic Information Technology
J Vaughn

SALES STAFF

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

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

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

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

List Rental Sales
Carissa Simmerman
csimmerman@advanstar.com
(440) 891-2655

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

Reprint Services
877-652-5295 ext. 121/ bkolb@wrightsmedia.com
Outside US, UK, direct dial: 281-419-5725. Ext. 121

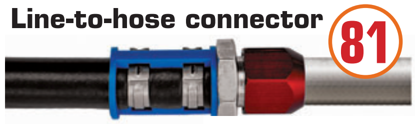

CARQUEST
SUPERIOR QUALITY
Remanufactured Starter
CALIDAD SUPERIOR
Motor de Arranque Reconstruido
QUALITÉ SUPÉRIEURE
Démarreur réusiné
CARQUEST
PREMIUM
New Alternator
PREMIUM
Nuevo Alternador
PREMIUM
Alternateur NEUF

OPERATIONS

TRENDING

PRODUCTS

Line-to-hose connector 81



APG 82

Brake lube line

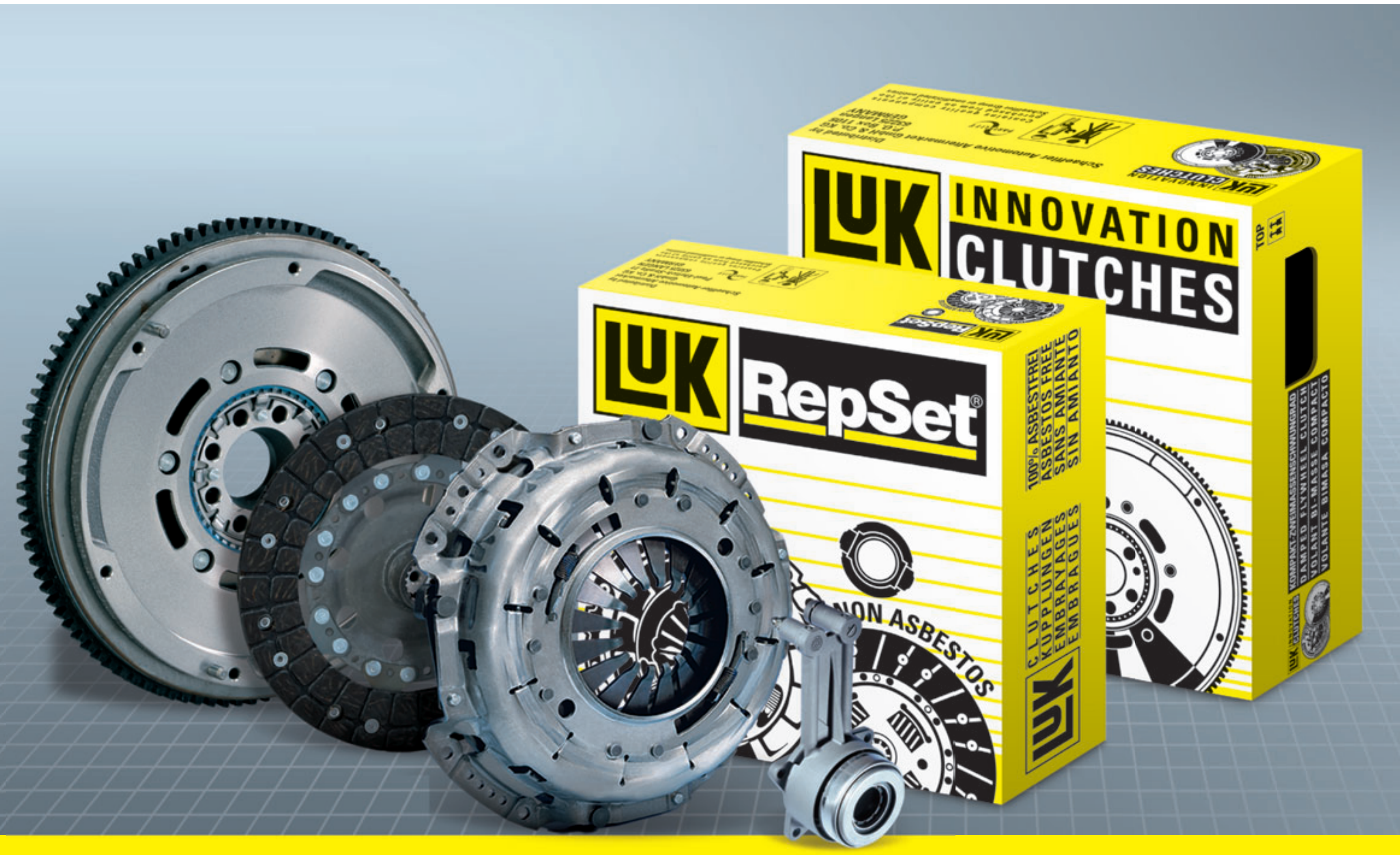
Motor Age (Print ISSN: 1520-9385, Digital ISSN: 1558-2892) is published monthly, by Advanstar Communications Inc., 131 W. 1st Street, Duluth, MN 55802-2065. Periodicals postage paid at Duluth, MN 55806 and additional mailing offices. **POSTMASTER:** Send address changes to *Motor Age*, P.O. Box 6019, 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: Pitney Bowes 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.**

AD DEADLINES:
Insertion orders–1st of month preceding issue date.
Ad materials–5th of month preceding issue date.

To subscribe, call toll-free 888-527-7008. Outside the U.S. call 218-740-6477.

Think “Inside” The Box!

Trust the quality of LuK. Trust the Yellow Box.



These days, it seems that everyone is telling you to “think outside the box”. When it comes to clutch replacement, that’s just not good advice. Many clutch marketers mix and match parts from various sources, a practice that creates quality and installation problems. The parts may bolt up, but can fail prematurely, resulting in a comeback for you. When you install a LuK RepSet®, you get the same flawless performance as the original equipment parts.

Designed and engineered to work together. The LuK RepSet® delivers performance, durability and a satisfied customer.

Why risk your time and reputation with anything else?

5370 Wegman Drive • Valley City, OH 44280
Phone 800 274 5001 • Fax 330 273 3522
www.Schaeffler-Aftermarket.us

Know Your Parts AASA

Certified to ISO 9001:2008

SCHAEFFLER
AUTOMOTIVE AFTERMARKET

LUK INA FAG

TRENDING
INDUSTRY NEWS, NOTES AND HAPPENINGS

ONLINE COVERAGE

THERE'S MORE ONLINE:

CURRY'S AUTO HIGHLIGHTS WHAT'S BEHIND HYBRID SHOP
Shop reports operations are rooted in sound technical methodology & proven processes.
»» MOTORAGE.COM/THEHYBRIDSHOP

AAEC ANNOUNCES BEST OF THE BEST AWARD
Extra-Tech Automotive Ltd. of Calgary, Alberta, Canada, has won the BEST of the BEST Award for 2012 from AAEC.
»» MOTORAGE.COM/AAECBEST

INDUSTRY LEADERS SET MEETINGS DURING ASRW
The ASA Affiliate Executive Director Leadership Forum is one event set for ASRW.
»» MOTORAGE.COM/MEETINGS

DISTRIBUTORS ADDRESS CHALLENGES AT GAAS
A GAAS panel talked about the changing demands, including consolidation and Obamacare.
»» AFTERMARKETBUSINESS.COM/DEMAND

CHANGES HIT THE INDUSTRY
Paul McCarthy with AASA outlined five issues facing your distributors at GAAS 2013.
»» AFTERMARKETBUSINESS.COM/5ISSUES

PAINTING PLASTIC PARTS
The type of plastic being painted will vary, and identifying which type of plastic you'll be painting is critical for a good paint job.
»» ABRN.COM/PAINTPLASTIC

BOOSTING BOOTH COUNT
Improvement in paint products, equipment and production systems have raised the number of jobs that could flow through your paint booth daily.
»» ABRN.COM/COUNTBOOST

Dave Walter and John Vallely, both Chicagoland shop owners, discuss shop needs at GAAS 2013.

Photo: Tschanen Brandyberry

GAAS 2013

Shop owners detail what they want

CHICAGO — While the majority of those in the GAAS audience were manufacturers, the shop owners' message to them and the suppliers was simple: They want a company they can trust.

Bill Moss, owner of EuroService Automotive in Virginia and ASA Mechanical Division director, led a panel of three Chicagoland shop owners at GAAS, as they told attendees "What Shops Really Need."

The owners all want a manufacturer and supplier, whether WD or jobber, that will back them up when a part fails on a vehicle. After all, it's the shop's name — and even the technician's name — on the line, not the manufacturer's name. In some cases, the consumer doesn't know what brand is used.

Bob Shanahan, owner, DuPage Tire & Auto Center Inc., says the shop is the advocate for consumers. They do a lot of parts research, which sometimes takes years. They think of who will stand behind the part, especially if something goes wrong. "We learn the hard way. There are certain brands that aren't into quality and they won't stand behind their parts. And when we have a question, they aren't there," he says.

John Vallely, owner of McLean Auto Repair, adds that "I depend on my distributor to problem solve when we're stumped. They may have products out there that have solutions; they may have procedures that have solutions."

— Tschanen Brandyberry, managing editor

BREAKING NEWS
SHOP PERFORMANCE

BOSCH HONORS BEST 3 SHOPS

The results of the "Best of the Best" Bosch Car Service (BCS) contest are in. Per the rules of the competition, three shop owners whose facilities best exemplify the standards of excellence upheld by the BCS brand have won the prize – a two-day trip with Bosch to Hendrick Motorsports in Concord, N.C. Each winning shop owner and a guest had the unique opportunity to tour the facility, watch pit practice, visit the engine shop, speak with engine department personnel and see Rick Hendrick's private car collection first-hand.

The winning submissions were from Curt Massoll of Curt's Service Inc. in Oak Park, Mich.; Sevan Garabedian, of Integrity Motorcar in Yorba Linda, Calif.; and Voit Rich of Autowerkes Maine Inc. in Freeport, Maine. Participants were judged on how closely the photo they submitted represented the Bosch Car Service brand.

Tony Stewart will be the first to tell you he couldn't do it without his pit crew. NASCAR® is a team sport, and Mobil 1™ is a crucial player. Like over half of all NASCAR drivers, Tony Stewart chooses Mobil 1 technology to help him win races. Who's on your team? See more at **facebook.com/mobil1**

Mobil 1™
MANY CHAMPIONS. ONE OIL.

Official Motor Oil of NASCAR


TRUST IS EARNED
CHALLENGES MET
The one thing that's more satisfying than solving a problem is preventing one. With the right parts, I can meet the toughest fixes head-on and make it right the first time. Because earning trust is at the core of everything I do.
ACDelco GM OE air conditioning compressors are the original-equipment solution for most GM vehicles on the road. They're 100% visual and leak checked, and they're backed by the Consumer Assurance Program* to help keep your word. It's just one of the many benefits that ACDelco offers to help make earning trust, easy. Visit acdelco.com or find us on Facebook at facebook.com/acdelco.
Like us on Facebook
ACDelco

CELL PHONES ON WHEELS

BY **MICHAEL WILLINS** | CONTENT DIRECTOR

There's no denying the rise of telematics in today's vehicles. Too many parties have a stake in this growing segment for automotive repairers to ignore it.

Pietro Berardi

"Telematics will be a revolution," says Pietro Berardi, CEO of Magneti Marelli, Global Aftermarket. "Vehicle connectivity for the future is a very big issue." Exhibiting at this year's Autopromotec show in Bologna, Italy, Magneti Marelli has developed a wide array of telematics products (for the OEMs as well as the aftermarket) to address the growing needs.

It wasn't that long ago independent shops considered a similar innovation to be "way off in the future." The Honda Insight first appeared in the U.S. in 1999, followed closely by the Toyota Prius. At the time, hybrid vehicle repairs were exclusive to dealerships, but as warranties expired and consumers sought less expensive repair options, technicians had to adapt. Today, hybrid training is vital.

Berardi believes training on telematics solutions will be just as important going forward. The aforementioned stakeholders have an overwhelming interest in operational efficiency and quality of life benefits associated with telematics, he says. "Telematics and sustainability are two of the top drivers that will change the future of the car industry," said Berardi.

Paola Carrea, head of telematics business development for Magneti Marelli, admits it's tough to grasp how soon this field will impact the aftermarket. But shops will have to explore new ways to service customers as a result of telematics. "The car is becoming a smart phone with tires," said Carrea. "We are in an era of connectivity. The car will be connected."

Independent shops will have to reshape their business to accommodate this. Think about how a consumer enters a cell phone retail outlet to resolve communication issues. Vehicle owners will likely expect the same service for troubleshooting repairs.

Telematics opens up a new world revolving around customer relationship management (CRM) and vehicle relationship management (VRM) by enabling shops and other parties to access vehicle data, said Carrea. Data collection can help troubleshoot failures or provide proactive maintenance information to keep customers safe.

2013 Top Shops contest underway

It's time once again for the annual *Motor Age* Top Shops contest.

The 2013 contest kicks off June 3, and you can get started now by downloading a PDF at MotorAge.com/TopShops, which includes all of the rules and what you need to submit to *Motor Age* to be considered for the contest.

The contest runs June 3 through Aug. 30, so take a look at the rules and entry information PDF and start your entry now. Shop owners will be required to answer questions about their operation and submit photographs of the shop. Judges will review all of the entries, with a winner being announced this fall.

As in previous years, shops from around the country will enter, with a chance to be featured on the cover of our 2013 December issue.

Download the form and enter today. If you have any questions about the contest, you can send an email to *Motor Age*'s Managing Editor, Tschanen Brandyberry, at tbrandyberry@advanstar.com.

Let us know if you have any questions. We can't wait to see your shop.

ASE GUIDES

QUESTION OF THE MONTH ?

SPONSORED BY Federated Auto Parts

☑SURVEY: A vehicle equipped with a MacPherson strut suspension is in for new tires and an alignment. The tech noticed the vehicle has some play in the left side inner tie-rod. What should he tell the client?

A. It isn't a problem that will affect alignment.
B. He can align the front end, but the tie-rod should be replaced soon.
C. The inner tie-rod needs to be replaced before an alignment can be performed.
D. He can set the vehicle alignment to compensate for the play.

Visit MotorAge.com/july13survey to answer the question and register for the monthly drawing from Federated Auto Parts.

FROM THE BLOG SPHERE

Keeping up with today's online technology

What does your shop really need to stay ahead of the game on the Internet?

BY **SHOPFIXER** | WORKSHOP MEMBER

What does the latest technology mean for your shop? Is any of it really necessary? Can you utilize things like "responsive" web design to better serve your customers?

Let's explore some of the new ways your shop can benefit from new online technology. In this first article, we'll cover responsive web design and what it means for your shop.

Responsive design is a way of making your website look good on browsers of all shapes and sizes. This doesn't just mean a regular website and a mobile website — it means big monitors, iPads, iPad Minis and Amazon Kindle Fire tablets, smartphones and every size in between.

Does your shop need a responsive design? If your website is only designed for desktops and laptops, chances are it doesn't display or work correctly on smaller screens like smartphones or even tablets. As somebody who uses both a smartphone and a tablet on a daily basis, I can't tell you how frustrating it is to zoom way in and swipe back and forth just to be able to read the text.

Adding responsive design to your website means it will be easy to

MotorAge.com BEST OF THE BLOGS

BECOME A BLOGGER
MotorAge.com/BestBlogs

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

Management_Success/California

Keeping customers happy

What does it take to keep customers happy or at least satisfied enough with your service that they will come back to you next time and maybe even refer their friends? The basic rules are simple:

1. Fix the car right the first time.
2. Treat the customer fairly and with respect.

But there are other important steps to take to make sure your customers are satisfied. Think like a consumer.

First, to figure out how to keep your customers happy, you have to think like a customer. Though most repair shop owners and employees are not consumers of vehicle repair services, they are consumers of other goods and services. Ask yourself what you consider good quality service. When you purchase something what do you expect from the product and from the company that sold it to you?

Junius/Alabama

Baptism by fire

Here is a story from one of my guys. He writes:

I about lost my mind today. As many of you know, half of my job during my deployment to Baghdad, Iraq, was a Bradley driver/mechanic. I didn't know much about them or how to operate them prior to, but that's OK, baptism by fire is a very expedited process.

Sometimes I worked on them while they broke down during patrols and missions and under the cover of Apache gunships (what a feeling of having a guardian angel that is). I even took the track on and off out in sector.

So today when we got to work on a civilian track vehicle, I was kind of excited to play with it.

We had to take the track loose on this piece of junk "Gotrack" -- I like to call it, the "garbagetrack."

We worked on that thing all day, and an hour from lunch, It was time to put the track back on. Due to the track tensioners being extended out, the track was proving to be too tight of a fit. We took the grease fitting off so the hydraulic tensioner would release the grease and loosen up. After fooling with it for an hour, I told both people I was working with that we needed to use a "deuce and a half" or greater vehicle to pull the track tighter and to pull the tensioners in. Read the rest at MotorAge.com/baptism.

use and easy to read on all screens. Eliminating the frustration of your potential customers can mean more potential sales.

Responsive design isn't a magic bullet, but it can make it easier for your customers to learn more about you online. This can mean the difference between somebody who visits your site and leaves, and a new customer for life. Read the rest of the blog at MotorAge.com/responsive. MA

MotorAge TOP VIDEOS

MOST WATCHED VIDEO

ASE's Tony Molla on the G1 test

SEARCH OUR ARCHIVES OF OVER 800 ONLINE VIDEOS
MotorAge.com/aseg1

Quick trans scan
What do you think of these numbers contributor Richard McCuistian recorded on a 2000 Jeep Grand Cherokee?
MotorAge.com/transscan

New brake pad guarantee
NUCAP is so confident in the NRS™ technology it announced a 100 percent Brake Pad Performance Guarantee.
MotorAge.com/nucap

P0300 misfire tips
A P0300 random misfire code can be very frustrating. The first step is to detemine which cylinder(s) are misfiring.
MotorAge.com/p0300

TO WATCH NOW

JUST SCAN IT
Scan the QR Code with your smartphone's camera, or go to: MotorAge.com and enter the [aseg1]

TO GET THE FREE APP:
FROM YOUR PHONE'S BROWSER, GO TO:
WWW.SCANLINE.COM

Noteworthy
comments from *MotorAge*'s online communities

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

greasyparts:
My service manager cannot fix every car. Nor can my top technician. They can be aware of what is being diagnosed and look at the test data to help the incompetence to become better at what they do and shield my customers from as much incompetence as possible.

KCThomas:
Yes! We do have a scope we don't use. I have new techs who are just starting to learn! This is an awesome idea. Thanks for staying the obvious! Sometimes we get wrapped up in day to day and forget the simple and common sense!

tooltym:
Dealerships often sell trade-ins from other manufacturers and offer warranties on them as well. It could also be because the customer had a past good experience with the dealership/service writer/mechanic etc.. Ultimately, it ends up in the bay because the service writer said yes, or they didn't feel the need to offer the customer a referral.

Rick Range via Facebook
I was part of the pilot testing for the G1. Very nicely done and will be a great introduction to ASE certification for those entering into the automotive repair industry or those that don't perform major repairs.

Joe Marconi via Facebook
Agree. We spend a lot of time at work, it has to be enjoyable.

join the community—join the discussion
MotorAge.com/Community

LEARN MORE: MotorAge.com IS UPDATED CONTINUALLY
ENTER WEBCASTS
SEARCH THOUSANDS OF ARCHIVED AND BREAKING NEWS STORIES BY KEYWORD

2013 WEBCAST SCHEDULE

AUGUST 2013
Cooling System Service and Testing
Produced in cooperation with TST.

AUGUST 2013
Get Familiar with the DCT450/470 Transmission
Produced in cooperation with ATSG.

OCTOBER 2013
Reading Wiring Diagrams
Produced in cooperation with ATSG.

NOVEMBER 2013
Electrical Testing Techniques
Produced in cooperation with TST.

STREAMING PROGRAMS

What it takes
iATN's Scott Brown originally brought this video to Pete Meier's attention on Facebook. While it's from the 1940s, the message it contains is as true today as it was then.

A real life look at an Impactool
Ingersoll Rand visited Karl Chevrolet Collision Center in Ankeny, Iowa, to see how professional technicians are using the 2025MAX ½-inch Hammerhead™ Low-Profile Impactool™.

Delphi's car of the future
Delphi teamed with world famous automotive designer Franco Sbarro to design a platform that showcases future technology today. Guys and gals, this is technology we will see in our lifetime — and have to deal with in our bays.

2013 INDUSTRY CALENDAR

JULY 19-21
ASA-Arizona Sunrise Convention
Phoenix

SEPT. 9-11
AAIA Fall Leadership Days
Dallas, Texas

SEPT. 20-22
ASA-IL CAN Conference
Exhibits and management and technical training.

OCT. 16-18
ASRW - NACE and CARS
Mandalay Bay, Las Vegas

HURRY.

20% OFF AFTER REBATE — OFFER ENDS SOON!

Magneti Marelli is teaming with Mopar® to offer a full line of repair and maintenance parts for all major makes and models. With products in over 30 categories, all backed by Mopar with an exceptional warranty, world-class quality and selection are only one call away.

MAGNETI MARELLI® | Offered by MOPAR®

Quality Automotive Parts for All Major Makes

Q+A WITH JIM DURKIN

SENIOR VICE PRESIDENT, COMMERCIAL BUSINESS, **ADVANCE AUTO PARTS**

ADVANCE IS EXPANDING ITS PARTS LINES AND SERVICES LIKE MOTOLOGIC AND DRIVERSIDE TO HELP YOUR SHOP.

BY **TSCHANEN BRANDYBERRY** | MANAGING EDITOR

Jim Durkin worked his way through high school and college in his dad's transmission shop. He hopes that experience, plus what he accomplished at Autopart International, will help him move Advance Auto Parts' commercial business ahead.

MA: **How do owners and techs fit into your plan for the commercial side?**
JD: I would put it in terms of focusing on helping the shop owner and technician be successful, such as helping them promote their business in the marketplace. DriverSide, our e-service offering, gives them electronic marketing tools, helps them build a database and helps them offer services to their customers so one of their customers can create a "My Garage." If we're talking about Jim's Automotive and I'm a customer of Jim's Automotive, Jim can now offer me My Garage. That shows the history of my car, will send me alerts of when it's time to change my oil, when it's time to do routine services on my car, and will provide the customer with tremendous value, driving business back into that particular shop.

We're going to continue to be invested in their success. We're offering them different programs like Anywhere Care, which is our warranty program, which they can buy into and then offer to their customers and cover their customers with warranty after they've done the work. A number of different services that we have available today, we're going to continue to offer to our customers and promote heavily to help them be successful.

MA: **How does Advance back today's shops beyond what's in the box?**
JD: We recognize the importance, too. It's a little bit of some of the previous things that I said. Some of these independent shop owners, they need a (warranty) program to be able offer to their customers. We have something that we've packaged that can be available to them, that they can in turn offer to their customers. We have things that will help them meet the needs of their customer, like a warranty program. We have the training programs, just helping them as cars become more complex and stay current on all of the changing and new developments in the industry. In some cases, it is as simple as making sure we stand behind the products that we sell, whether they happen to have a defective product, we take it back and replace it quickly for them. We make sure we're providing quality parts in the first place that minimize comebacks and give them the piece of mind of the quality of parts.

JUST SCAN IT

Scan this QR Code to read more on your smartphone from Jim Durkin. Or visit MotorAge.com/JimDurkin

GET A FREE SCAN TOOL APP AT: www.scanlife.com

MA: **How is Advance expanding its offering to today's shops?**
JD: I think it's consistent with the strategy that we've had. But some recent expansions that have really helped us availability and frankly quality of parts. We continue to fill out our line with MOOG, and we've continued to fill out our line with Intermotor and BWD, so expanding categories like that improves our availability and improves our assortment overall and makes sure we have the parts that our customer is looking for. We continue to invest in our Platinum brake line, and we're having success with that and getting great feedback from our customer. It's investments like that in availability, but also in assortment in those specific categories that's helping us. MA

Photo: Advance Auto Parts

OPERATIONS
TAKE CONTROL OF YOUR BUSINESS

IN THIS SECTION

read it on MotorAge.com

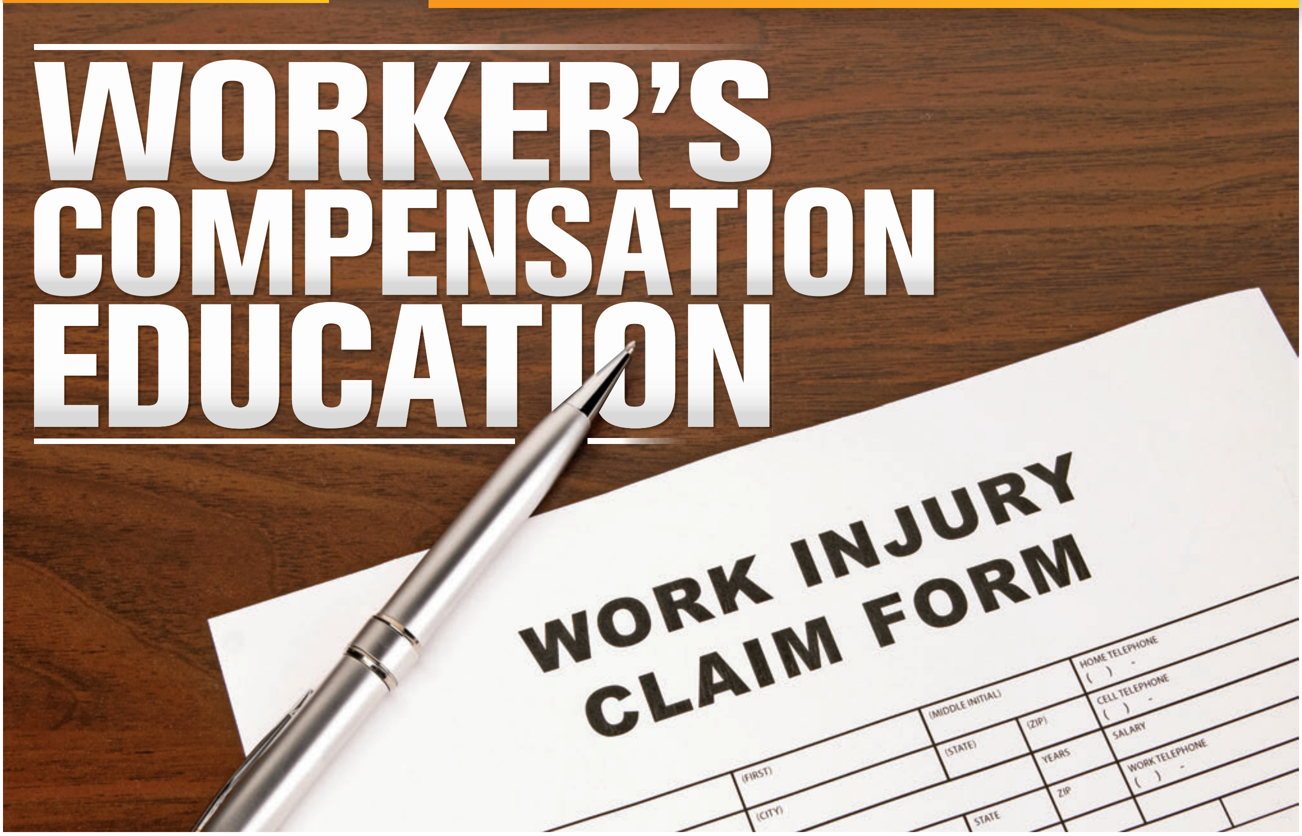
A LESSON IN MARKETING
ESi seminar shows shop owners how to market to today's customer.
/esimarket

2013 TOP SHOPS CONTEST
It's that time of year again to see if your shop is among the best.
/topshops

SAYING THANKS
How you treat your people reflects in how they talk about you and the shop.
/sayingthankyou

MANAGEMENT

WORKER'S COMPENSATION EDUCATION



PROTECTING YOUR TECHS AND OTHER STAFF MEANS LEARNING THE RULES AND TEACHING SAFETY.

BY **BRIAN CANNING** | CONTRIBUTOR

IN DOING research for this piece and being conscious of the fact workers' compensation is not nearly as sexy as that new marketing plan you were thinking about buying, I wanted to touch on one of those real world (and decidedly un-sexy) realities that any shop owner in the United States must face and manage if he or she wants to be successful and thrive.

Workers' compensation is a form of insurance. It provides wages and medical benefits to employees injured on the job. In most cases, it comes in exchange for the employee's right to sue an employer for negligence. This trade off between assured, limited coverage and lack of recourse outside the workers' compensation system is known as "the compensation bargain." Damages, both general and punitive for things like negligence, generally are not available in workers' compensation plans.

In the United States, most employees who are injured on the job have an absolute right to medical care for any injury, and in most cases, compensation for resulting disabilities, either short-term or permanent. Most employers, with the exception of those from Texas, are required to subscribe to insurance for workers' compensation, and an employer who does not can be fined. Texas employers have the ability to opt out of the workers' compensation system under state law. These employers are known as "non-subscribers," and are exposed to potential liability in the event of an on-the-job injury. Though the employee must prove that the employer was negligent in causing his or her injuries (this is significant), if successful, the employee can recover full damages, which are much more generous than workers' compensation benefits.

Coverage includes two types of protection: workers' compensation and employer's liability. The workers' compensation portion of the policy pays for claims made by employees, and the employer's liability portion pays the cost of

JUST SCAN IT

Scan this QR Code to read a discussion about customer-supplied parts and protecting your staff. Or visit MotorAge.com/partsdiscussion

GET A FREE SCAN TOOL APP AT: www.scanlife.com

Photo: ThinkStock

defending lawsuits filed against the company by an employee or an employee's family. Workers' compensation benefits provide coverage for medical expenses as well as reimbursement for lost wages when employees are injured on the job.

On the flip side, insurers are seeing an increase in fraud cases, including workers' comp claims. MotorAge.com/fraud

Avoid Becoming a Statistic

The best way to control your workers' compensation costs is to create a safe work environment. You might even consider safety training as one of your preventive measures. As work environments become safer, the number of workers' compensation claims continues to decline. At the same time, the cost per claim has risen more than 25 percent in the last several years, making the business expense and impact substantial. Workers' compensation is something that every small business owner with employees must deal with.

The U.S. Bureau of Labor and Statistics has compiled data showing that five industries account for a vast majority of injuries that occur and where the vast majority of workers' compensation claims are made: emergency responders, transportation industry workers, cleaning professionals, law enforcement and those in the criminal justice field and HVAC workers.

While I am surprised the tire and automotive repair industries are not represented in this at-risk group, the money spent and impact that workers' compensation has on these industries is significant and trending upward, even as the number of actual claims declines.

Workers' compensation laws rely on a "no fault" rule that provides benefits regardless of who is responsible for a workplace injury. There are exceptions for employees who hurt themselves due to reckless behavior or drug abuse, though rulings tend to give the benefit of the doubt to employees, except in the most extreme circumstance. In addition, employees who cause self-inflicted injuries, or injure themselves while off-duty or while engaged in a criminal act, usually do not qualify for benefits. State laws vary as to what kinds of activities are covered under workers' compensation.

Responsibility as an employer varies from state to state. It is universal in the U.S. that if one of your employees is injured, you need to immediately file a workers' compensation claim with your insurance carrier. Your insurance carrier will then notify the appropriate state agency. A state agency typically reviews a case to determine whether it is valid and what benefits the injured worker should receive.

Timely reporting is an important key in all of this, particularly for the employer. Being slow to report, even if it is just you being lazy and not malicious, is a way to assure a negative backlash, both from your injured employee who will feel mistreated and from a state agency.

The U.S. Department of Labor's Bureau of Labor Statistics shows that businesses spend on average just less than $27 per hour for each employee. This includes salary, as well as benefits. Overall, 70 percent (or $18.90) of the hourly compensation given to employees goes toward salary, and 30 percent ($8.10) goes toward benefits, with 1.8 percent ($0.15) of that benefit percentage making its way to workers' compensation. Though 15 cents an hour isn't much, it adds up and it can severely impact your ability to turn a profit.

In a typical shop, technician's rates would tend to run the highest and cashiers and bookkeepers significantly lower with service advisors somewhere in between. The basic rates for each job classification are set by each state. The main determining factor in workers' compensation insurance premiums is the classification of job positions according to their level of injury risk. States set the basic rates for job classifications codes, of which there are more than 600.

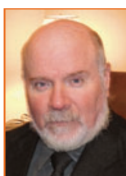
Each state's workers compensation statutes are unique, so you need to check with your State Insurance Commissioner's office or your insurance provider to find out about rules that govern your shop. Depending upon where you live, you can buy coverage through the state or a private insurer; some states offering business owners a choice. If your state doesn't offer a state-run insurance fund and you don't qualify for private insurance, you will be insured by an assigned risk pool.

Staying out of a state-assigned risk pool is important in controlling your workers' compensation rates. If you are in an assigned-risk pool due to a poor safety record, you'll pay high premiums. Find out from your insurer or state agency why you are in a risk pool. If the problem is your shop's safety record, you should take immediate steps to improve safety and reduce the chance of accidents in your workplace.

Safety is not hanging posters and telling your people to be safe twice a year. It needs to be part of your shop culture. If you are not committed to a safe shop, your shop is not going to be as safe as it could and should be. Give each employee a copy of your safety manual (create one if you don't have one) that details safety rules and safe work practices. Conduct regular inspections of the facility to identify and correct safety hazards such as poor lighting, unsafe conditions and cluttered work areas.

Communicate the importance of safety in the workplace and reward and recognize improving safe behaviors. Punish or reprimand habitual safety policy violators. Write and distribute safety procedures unique to your shop and enforce them. Start keeping records of all accidents and set reasonable goals for improvement, periodically inspecting what you expect. Create return-to-work programs for injured workers, and stay in close contact with workers who are out injured and unable to work. Have the right shop equipment for the job. Provide protective equipment such as goggles, ear protection, helmets and gloves and make sure it is used.

A commitment to safety in your shop is an investment in your employees and your business' viability.



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

SHOULD YOU BE LISTENING TO YOUR EMPLOYEES?

YOU WANT YOUR CUSTOMERS TO LISTEN TO YOUR PEOPLE, SO WHY AREN'T YOU?

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

Photo: ThinkStock

SHOULD you listen to your service advisor? Should you listen to part-timers who help you keep the shop looking great? How often should you talk with them?

Working with shop owners for more than four decades has taught me a lot about running a business. In the past 10 years, I have seen more change in our industry than in the previous 30. We have had to learn many new skills, and believe me when I tell you I hate change. I was listening to a shop owner from Nebraska, Rick Johnson, explain how to keep your business growing. He is a coach at ATI and has taught this successfully to hundreds of owners.

Rick has a good friend whose son is an airline pilot. One day she was telling him about something her son talked to her about — "situational awareness." It is simply the ability to see objects in time and space through multiple perspectives and interpretations. Simple, huh? He said, "Mom, even though we have all these wonderful instruments that tell us how fast we are going, how high we are flying, how much fuel we have and how well things are running, it is still important to look out the window once in a while and see for ourselves just how things are looking."

Situational awareness involves being aware of what is happening in the vicinity in order to understand how information, events and one's own actions will affect goals and objectives, both immediately and in the near future. One with an adept sense of situational awareness has a high degree of knowledge about the inputs and outputs of a system, i.e., an instinctive "feel" for people and events — for the situations that play out due to variables the subject can control. Another definition is "the perception of elements in the environment within a volume of time and space, the comprehension of their meaning and the projection of their status in the near future." And probably my favorite, "Knowing what is going on so you can figure out what to do."

Increasing Productivity

So how does all this apply to your shop? After all, we are not flying high-tech airplanes here — or are we? I have always been told that a service writer is much like an air traffic controller. The advisor handles all the traffic coming into the shop and all the traffic leaving the shop, watches for collisions of time constraints, promised delivery times and parts ordering, and keeps track of the techs' needs as well.

JUST SCAN IT

Scan this QR Code to get more on your smartphone. Or visit MotorAge.com/ProfitMatters713

GET A FREE SCAN TOOL APP AT: www.scanlife.com

"WHAT DO YOU THINK IS THE BIGGEST REASON EMPLOYEES LEAVE? TYPICALLY IT IS MORE ABOUT NOT BEING LISTENED TOO OR RECOGNIZED THAN IT IS ABOUT THE MONEY!"

CHRIS "CHUBBY" FREDERICK [CONTRIBUTOR]

The techs keep this well-oiled machine cranking out all the production, and the owner (pilot) needs to fly this ship and watch for any hazards and fly around them as they come up. When the shop has good communication from the control tower to the techs and the owner, things can fly along pretty smoothly. However, when something breaks down, it is amazing and scary how fast we can crash and burn.

We definitely have a lot of "wonderful instruments" to monitor our business. At ATI, we call them Key Performance Indicators (KPIs). We can see average repair orders, parts margins, labor margins, car count, gross profit and many other indicators of how fast we are going, how high we are flying and how much fuel we have. So, like the pilot, do we need to just watch the gauges, or do we need to "look out the window" and practice situational awareness as well?

Situational awareness applies not only to high-tech equipment, but also to people. We must apply this to our staff as well as to our equipment. It is important for us to take a look around, not to focus only on the instruments or KPIs, but to become aware of our environment. After all, employees make our instruments run and reports come to life. How long has it been since you have taken the time and effort to meet with your staff? To take their "temperatures" and see how they are running? To see how fast they are going and how much fuel they have left?

Don't Forget

In today's fast-paced shop and high-tech world, it is easy to forget we are working with some of the most important equipment in our shops and that is our employees. Taking time to meet with them has almost become a forgotten skill. I realize that production is important, but what good does it do to run so hard that we forget to stay aware of our employees' KPIs? Paying attention to our employees is easier than you might think and takes very little time, and the results are amazing.

A great way to do this is to set up one-on-one meetings weekly with each employee. Take time to set up a notebook and list the employee's strengths and weaknesses and go over it with them to come up with a battle plan of how to help them work on the things that need to improve, to equip them to be successful. Give them honest feedback on the things that are going well. And celebrate with them when a weakness becomes a strength!

It is a good idea to use this notebook to list the strengths and weaknesses of the pilot (you) as well. Develop a plan to work on weaknesses to make them strengths. Same applies to the shop building and equipment. Think of it as a pre-flight checklist, something you use weekly before your daily "flights."

Increasing Tenure

Interacting in this way can help ensure that the business runs smoothly and that most crashes can be averted. A lot of techs tell me they feel like a cog in the wheel and their opinions do not matter. These are the techs who suddenly give two weeks' notice and are gone, and we never knew there was a problem. Maybe if we had taken the time to be aware of their situation, perhaps with one-on-one weekly meetings, we would have given them the platform to give us a heads-up concerning a problem that we could have done something about.

I have also talked to a lot of techs who love their jobs and feel their opinions do matter, who do get a chance to meet with management or ownership so that their voice is heard.

Nothing can ground a flight faster than one or two key members of the crew leave and have to be replaced. Attitude controls our altitude, and I believe with constant and methodical situational awareness, we can all reach new heights with our businesses.

We do have a document that will guide you in setting up and facilitating these meetings and help you "look out the window." Take advantage of this limited time offer by simply going to www.ationlinetraining.com/2013-7. MA

CHRIS "CHUBBY" FREDERICK
CONTRIBUTOR

Chris "Chubby" Frederick is the CEO and founder of the Automotive Training Institute. ATI's 108 associates train and coach more than 1,100 shop owners every week. This month's article was written with the help of Rick Johnson, a successful shop owner, former ATI client and now coach at ATI.

Email Chubby at cfrederick@autotraining.net

SHOP PROFILE

A snapshot of one of the industry's leading shops

AC AUTO SERVICE CENTER / WINSTON-SALEM, N.C.

It takes a village

While it takes many people to make a shop successful, this owner's inner-tech had to go.

BY **ROBERT BRAVENDER** | CONTRIBUTIOR

"I had to kill the technician to become the manager," admits AC Guarino. No, this wasn't a confession but a realization. "I was getting in here at 4 a.m. and working until 11, 12 o'clock, and I realized I just wasn't getting ahead."

Shortly after starting AC Auto Service Center in Winston-Salem, N.C., Guarino knew he had to change for both him and his shop to survive. In search of answers, he began attending trade conferences, eventually running into Mitch Schneider, a name well-known to *Motor Age* readers. Guarino asked the shop owner and columnist what a person starting out in business should do. Schneider scribbled a note on a piece of paper and handed it to him.

It said, "Read 'The E-Myth' by Michael Gerber." Subtitled "Why Most Businesses Don't Work and What to Do About It," this seminal publication posits the theory that most new businesses are not necessarily started by entrepreneurs, but technicians. Be they bakers, graphic artists or auto mechanics, they enjoy doing hands-on work themselves, still working for the business rather than on it.

"Coming from a technical background, I probably had to read it five times before I understood it," says Guarino. But he was simultaneously synthesizing ideas from other business gurus like Bob Cooper and Gary Gunn, particularly the latter, whom Guarino met after attending one of his seminars.

"Gary was teaching measurements, how to really look at the P and L, how to look at the balance sheet, how to measure things and write them down, graph them," he recalls. "That really interested me, but when he mentioned the E-Myth, that really piqued my interest. So Gary and I started a relationship that still goes on today and has grown."

Today AC Auto Service succeeds because Guarino works just as hard at managing the business as he was the technician. To set himself apart from other shops, he instituted extended hours, 7 a.m. to 7 p.m. Monday through Saturday. Then there's his manual, a book he's compiled over the years for training his personnel, the basic theme being that they are a "yes" company.

"We do not say, 'No,'" says Guarino. "Because if you don't have a sale set up with your employees, I wouldn't spend a dime on marketing; you're not ready. Say somebody's going to come in with sales flyers for an oil change, and you're just going to say, 'Sorry, can't get you in.'

AT A GLANCE

AC Auto Service Center
Shop name

AC Guarino
Owner

Winston-Salem, N.C.
Location

1
Number of locations

18
Years in business

11
Total number of employees

4
Number of technicians

5,740
Shop size

8
Number of bays

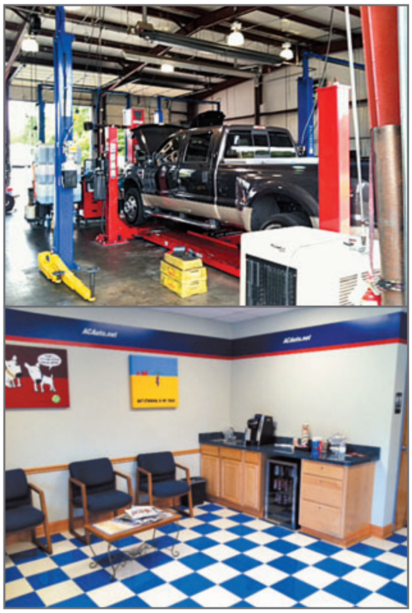
163
Average vehicles per week

$150
Average weekly repair ticket

$1.3 million
Annual gross revenue

IGONC, AASP
Shop affiliations

Photos: AC Auto Service Center



You just wasted every penny you spent (on marketing). You get them in there."

That's where the 10-10-10 formula comes in: 10 minutes of looking the car over; if a problem is found, 10 minutes of sale ("There's nothing wrong with the word sale, although some people think it's a four-letter word," he adds) and 10 minutes to complete the oil service.

"Or not," laughs Guarino. "They might decide to go ahead and get the work done. Not only have you made a sale, but you've bought a little time. If you haven't started draining the oil, you can take that car out back and get the customer home; we have a shuttle driver ready to go. Now some people, in my case more often than not, decide to wait, because I have a real beautiful waiting room with a 60-inch TV, coffee, soft drinks — why should they want to be anywhere else?"

Perhaps the greatest thing Guarino has accomplished is networking with other shops. "Join a group," he advises. "It's the best thing in the whole world to do. I learned from others; find some place that fits you and your personality. Keep ego out of it. I see so many (shops) fail because of ego. Even if you're the best technician in the world, you've got to let ego go or you're going to fail because you haven't changed yourself."

As a member of the Independent Garage Owners of North Carolina (IGONC) and the national Alliance of Automotive Service Providers (AASP), Guarino feels that "we've taught each other through our failures, our thinking. We run things by each other all the time. We do it now by Internet and then we meet three times a year. Some of us have gotten to the point where we just hone in on our philosophy and see how steadfast we're staying."

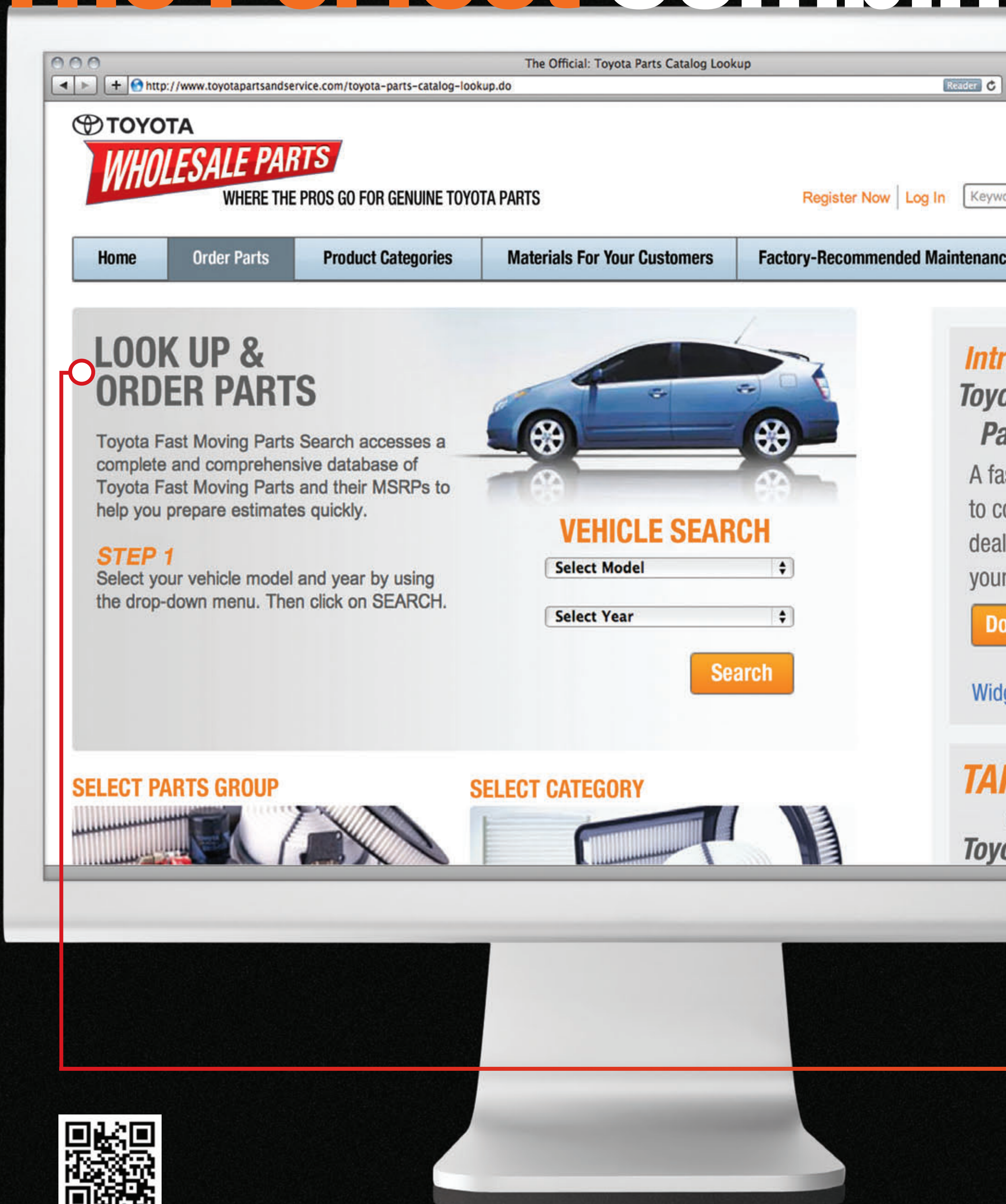
With the knowledge and experience he's accumulated, someday AC might find himself in a hotel lobby giving advice to a newly minted shop owner. MA

ROBERT BRAVENDER
CONTRIBUTOR

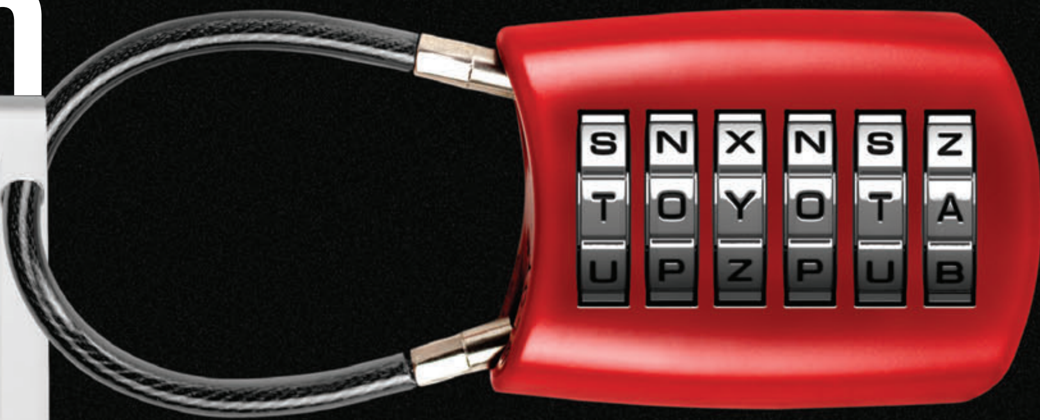
Robert Bravender graduated from the University of Memphis with a bachelor's degree in film and video production. He has edited magazines and produced shows for numerous channels, including "Motorhead Garage" with longtime how-to guys Sam Memmolo and Dave Bowman.

Email Robert at rbravender@comcast.net

The Perfect Combin



ation



In a perfect world, you'd have the best quality part, all the information you need, and the easiest way to order.

eod y

This is the one combination that's easy to remember. Designed and tested with specific Toyota models, turn to Toyota Genuine Parts to lock in the fit, the quality and the performance that will give you—and your customers—total security.

eodt S f mt

With Factory-Recommended Maintenance Schedules, as well as access to the Toyota Technical Information System (TIS), including Repair Manuals, Service Bulletins and a lot more, you can get the answers you need to satisfy your customers, 24/7.

eodc y da d dW so

With access to the Toyota Electronic Parts Catalog (EPC),* VIN-based searches and the same Toyota Parts data your dealer has, you can lookup and order Toyota Genuine Parts from your Toyota Dealer online, and prepare estimates quickly and easily.

**Available through Toyota STAR Elite Dealers.*

TOYOTA WHOLESALE PARTS

yvt sr o nmohi f

read it on MotorAge.com

NO UP SHIFTS
These VW owners are trying to avoid an overhaul. Can this shop fix the issue?
/noupshift

TOYOTA TROUBLE
When a shudder can be felt only at certain speeds, you might lock up, too.
/toyotatrouble

A 2ND GLANCE
With changes made to Subarus, you can't tell with a glance.
/2ndgla nce

The 4L60 Evolution

E CAN STAND FOR ELECTRONIC OR EVOLUTION – OR BOTH AT SOME POINT IN THIS CASE.

BY **WAYNE COLONNA** | POWERTRAIN PRO PUBLISHER

GM'S 4L60-E, 4-speed longitudinally mounted transmission with a strength rating of 60, was designated with an E to indicate that it is electronically controlled. However, since its inception in 1993, this transmission has received an endless list of changes and updates rendering the meaning of E to double as evolution. A basic overview of the changes made to the electronics alone will prove my case.

From 1993 to 1994, the transmission originally was fitted with a Pressure Control Solenoid, two Shift Solenoids (A and B), an on/off-type TCC Solenoid, a PWM 3-2 Downshift Solenoid, a Pressure Switch Manifold and a Vehicle Speed Sensor.

In 1995, a PWM TCC solenoid was added to the system to work in conjunction with the on/off solenoid. The on/off solenoid turned the converter clutch on and off, while the PWM solenoid controlled the rate in which the clutch applied and released. Some models received an external two-harness connector Park/Neutral Position switch on the manual arm shaft.

In 1996, the PWM 3-2 Downshift Solenoid was changed to be an on/off-type solenoid. This configuration of electronics remained in play until 2005 with one exception. The two-harness connector Park/Neutral Position switch was redesigned in 2000 and is referred to as the PNBU switch. In 2004, this switch was redesigned again, and has only one harness connector.

In 1997, the Electronically Controlled Capacity (Converter) Clutch (EC3) strategy was introduced in W body 3.4L passenger cars and then used in all models in 1998. EC3 is a slip-controlled converter clutch-apply strategy as early as second gear to a rare full apply under specific highway cruise conditions. This continuous low rpm converter clutch slip still improves fuel economy while further enhancing drivability by reducing driveline torsional disturbances.

As a result of computers being redesigned and/or programmed to accommodate these many changes, a variety of issues can come up when the wrong year transmission and/or torque converter is installed into a vehicle. One such example is when the first design 1993- or '94-type transmission is used in a 1995 vehicle. This would cause an electrical fault code for a PWM TCC. Or, use this same early design transmission in a 1996 vehicle, and you will have codes for both the PWM TCC solenoid and the 3-2 downshift solenoid.

In 2006, a very significant change took place. An internal Input Speed Sensor (ISS) was added to the system (Figure 1). This allowed the computer to monitor the shifts and gear ratio for enhanced line pressure control. Aside from a new input to the computer and its related program, changes also were made to the internal wiring harness and pass through connector.

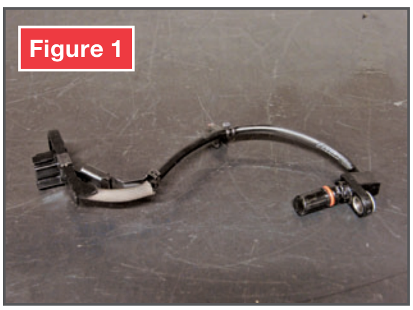
In 2009, two more significant changes occurred. The 3-2 Downshift solenoid was eliminated as a result of the enhanced line pressure control the ISS strategy provided. And the external PNBU/NSBU was replaced with and Internal Mode Switch, which also eliminated the internal pressure switch manifold.

The many noteworthy changes to the 4L60-E's electrical system alone certainly qualifies the E to mean evolution, and we have yet to mention any constructional changes.

Both the case and internal parts received various changes over the years. In fact, there has been such a number of them it's not possible to cover them in one article.

Some of these changes were phased in over a period of time rather than being immediately implemented. This

Figure 1



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

Photos: Wayne Colonna

WE SPEAK TRANSMISSION.

We also eat, sleep, and breathe it.

Whether you need parts, advice, or answers to your tough technical questions, one call to Transtar is all it takes. With four decades of transmission experience, you can trust us to provide the products, support, and expertise you need to get the job done right.

Get the parts and advice you need, fast. Same and next day delivery on most orders.

TRANSTAR®

Trust the Experts

855-800-5585

Transtar1.com

Our partners in dependability

AAM Power to DELIVER · AMERICAN AXLE & MANUFACTURING | Koyo® Ball & Roller Bearings | SUPERIOR TRANSMISSION PARTS, INC. THE SIMPLE SOLUTION | ACDelco | TRANStec® | HAYDEN AUTOMOTIVE TRANSAVER | ZF

To Another 50 Years of Golden Partnerships!

It's the Golden Anniversary of all the folks at Mighty who have dedicated five decades to creating the envied Gold Standard to the automotive professional.

And what makes this occasion "golden" is the special bond of partnership and friendship with you, our customers.

That's how it's been since 1963.

That's what it's all about today.

And that's how it will always be.


OE Quality Parts
Extraordinary Service
Inventory Management Expertise
Tools to Help Grow Your Business
Exclusively for the Pro
www.mightyautoparts.com
Mighty
AUTO PARTS
CELEBRATING 50 YEARS

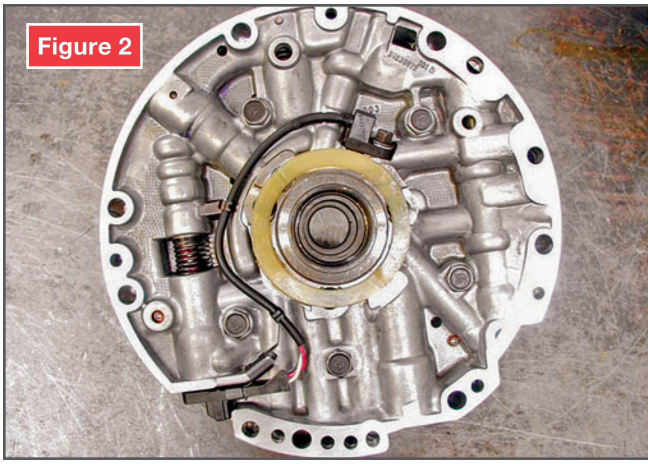


Figure 2

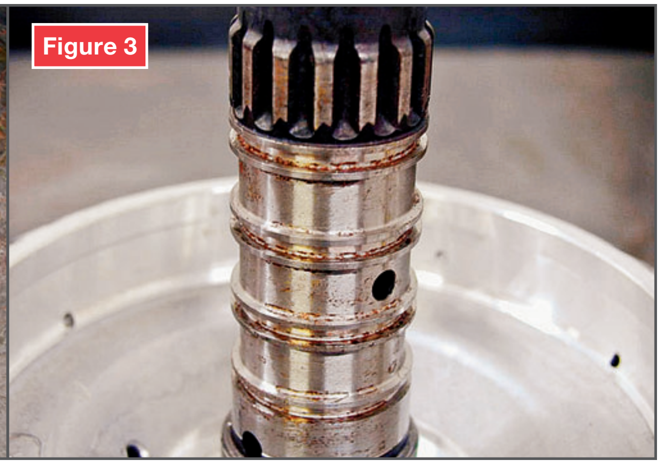


Figure 3

widens the margin of mismatching parts during a rebuild as some of these changes were very subtle. An example of this was when they added an internal input speed sensor to the 4L60-E in 2005. The sensor is mounted on the pump (Figure 2), which reads rotor teeth that was added to the input (turbine) shaft (Figure 3). To accomplish this task, dimensional and hydraulic changes needed to take place with both the pump and input shaft.

These dimensional changes accommodated the added rotor teeth on the input shaft, the repositioning of the sealing rings on the input shaft, the added sensor on the pump, its harness and connector so it can plug into the already existing harness which too had to change (Figure 4).

The implementation began in February with a new design TCC valve in the pump. This new design utilizes only one spring as opposed to the previous two-spring design. In March, a more compact boost valve and sleeve was designed to shorten up the length of the Pressure Regulator Valve line up in the pump. This was done to make room for the ISS harness connector.

In July, the pump casting was modified to accept this new harness. No holes were bored yet for the sensor itself or for the sensor's mounting hole.

A change to the hydraulic circuit in the pump also was made. Part of this change included a modified stator shaft and stator shaft sleeve (Figures 5 and 6). This was done to accommodate changes made to the input shaft. To add rotor teeth to the shaft to be used to excite the speed sensor, the sealing rings on the shaft had to move (Figures 7 through 9, page 30). This is why hydraulic changes to the pump needed to be made as well as repositioning the stator sleeve (Figures 10 and 11, page 30).

During model year 2006, the full implantation took place. However, there are some models that did not receive the ISS. In these cases, there is a plug bolted down into the sensor hole. If this is left out (Figure 12, page 30), a loss of converter charge pressure will occur resulting in a no move complaint.

Some of the mismatches that easily can occur are to use an input shaft that can fit dimensionally into a system that uses the ISS sensor in the pump yet the rotor teeth is not on the shaft. Codes P0716 or P0717 will be stored, which could cause TCC slip and gear ratio calculation errors.

If dimensionally different pump covers and input shafts are mismatched, severe friction and geartrain damage will occur in a short period of time. To help prevent making these errors in parts, look for a newsletter this month called "Pump and Input Shaft Usage." This bulletin will identify the progressive changes that were implemented to assist you in getting the parts right.

Some of these 4L60-E ISS applications use a separate TCM instead of being integrated into the PCM. These TCM's have been known to give problems due to its design. Most recently, Elio Jr. from WiWi's Transmission in Miami called me with a 2010 Chevy Truck Express 1500 RWD V6-4.3L using a 4L65-E transmission. It had a No/Low Input/ Turbine Speed Sensor Signal code

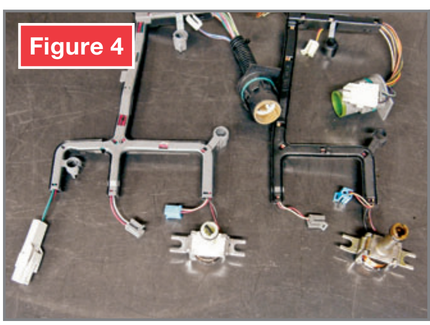


Figure 4

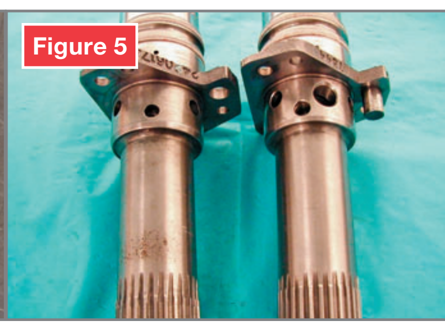


Figure 5

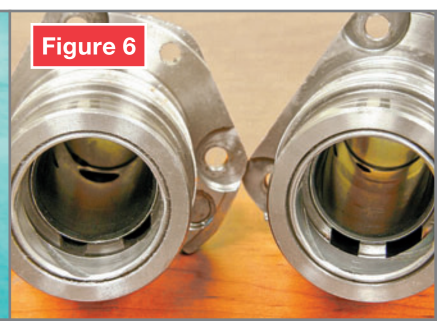


Figure 6

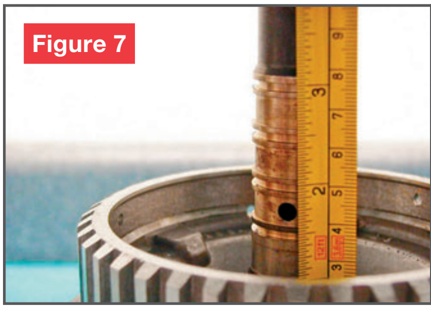


Figure 7

Figure 8

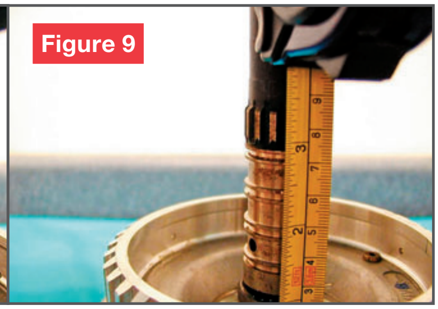


Figure 9

P0717. He had already diagnosed it down to a defective TCM and invited me over to take a look at it.

When I arrived, he had the TCM on the bench (Figure 13). This little guy is attached to the right inner fender between the battery and the blower motor. We flipped it over and took the back off as you can see in Figures 14 through 16, page 32. In doing so, we saw these very thin wires (.010-inch) being used to complete the circuit from

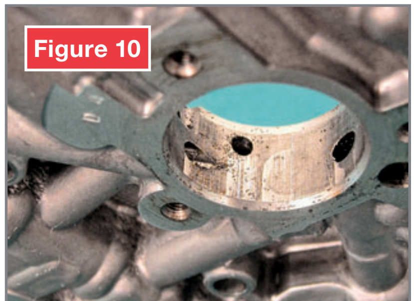


Figure 10

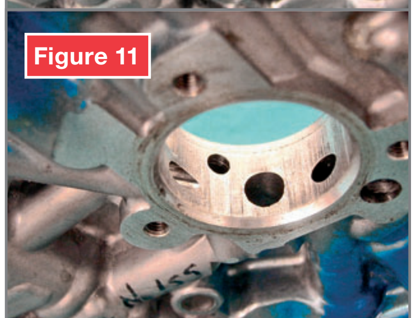


Figure 11

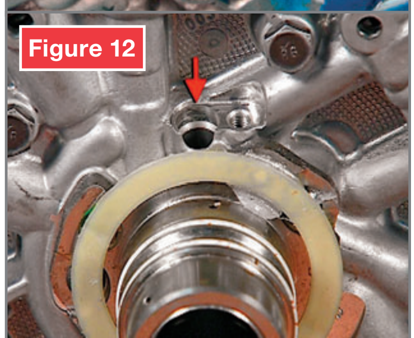


Figure 12

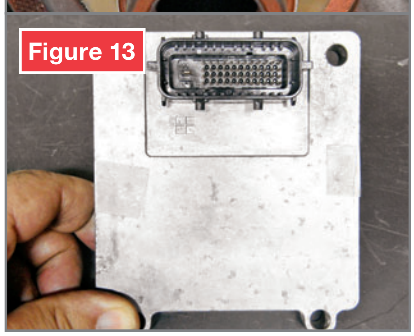


Figure 13


Figure 14

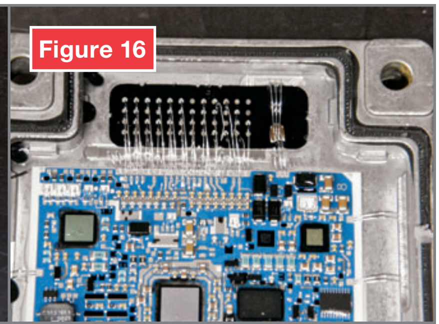


Figure 16

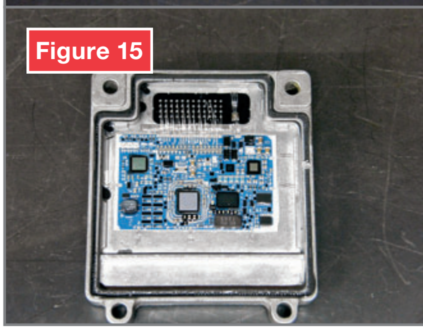


Figure 15

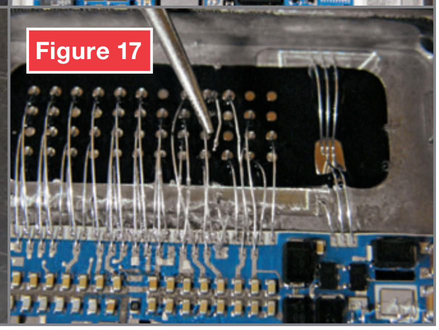


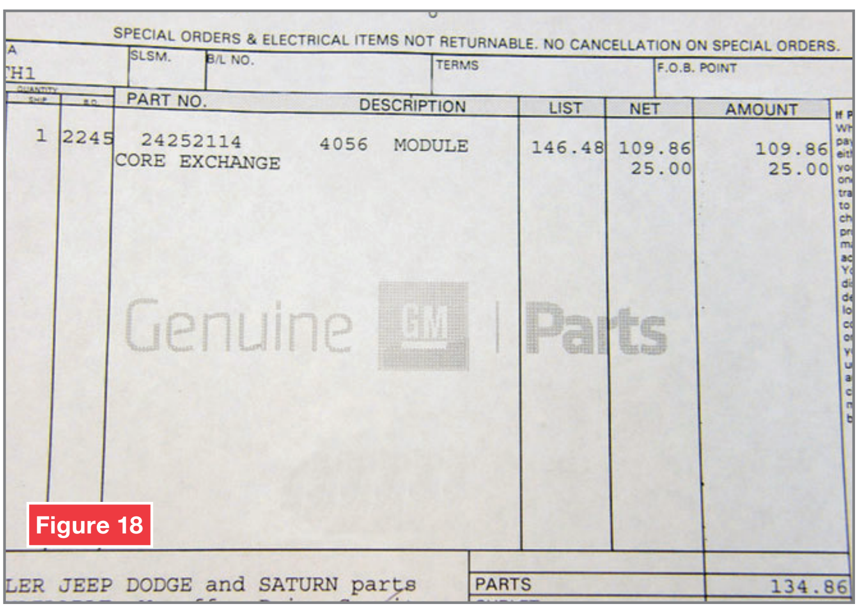
Figure 17

the connector terminals to the circuit board. Upon a very close look, we saw a broken wire going to terminal 45 (Figure 17). Terminal 45 happens to be the low side of the ISS and the reason this Hall Effect sensor stopped providing a speed signal through terminal 3.

The TCM lists for $146.48 and nets for $109.86 with a core charge of $25 (Figure 18). It cost $150 to program the TCM. Throw some labor on top of that, and this little wire cost the owner close to $500. But if you are good at soldering, this could be an easy in-house repair.

With the TCM being next to the battery, there is another issue with the TCM of which you will want to be aware. There have been times where the TCM is accidently shorted to battery voltage. In fact this has occurred enough times that even GM has issued a bulletin regarding this dilemma (05-07-30-016C). In their bulletin it states: "It has been found that if the positive battery jump start post/terminal cover is removed and/or missing, and the TCM comes in contact with the positive battery jump start post/terminal during diagnosis and/or service, the TCM WILL BE DAMAGED and require replacement."

Many thanks to Elio for inviting me over to his shop and for paying the TCM core charge so I could take pictures and share this information with you. MA



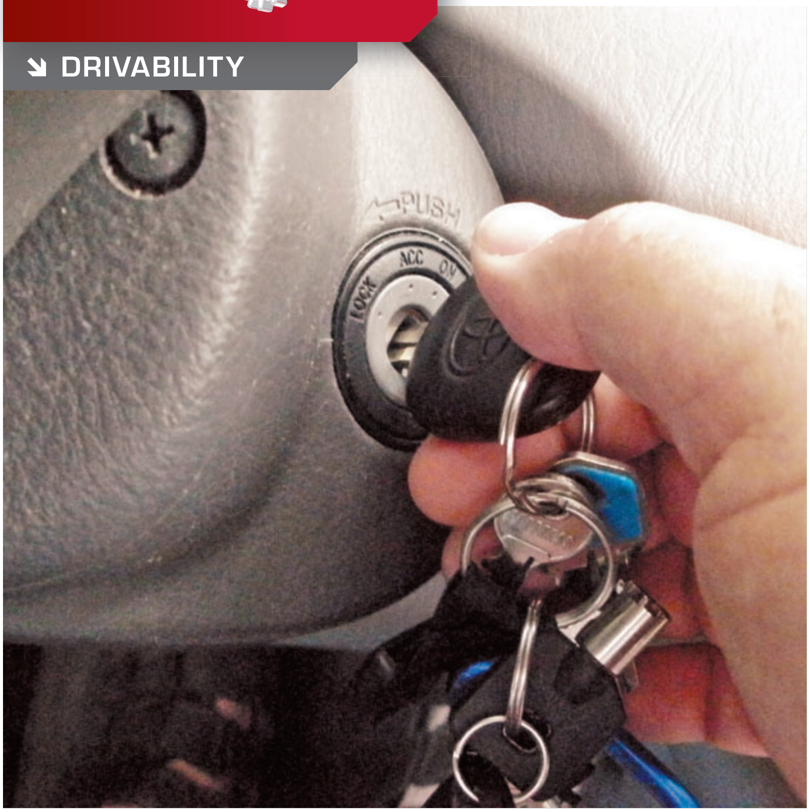
SPECIAL ORDERS & ELECTRICAL ITEMS NOT RETURNABLE. NO CANCELLATION ON SPECIAL ORDERS.

QUANTITY SHIP	B.O.	PART NO.	DESCRIPTION	LIST	NET	AMOUNT
1	2245	24252114	4056 MODULE	146.48	109.86	109.86
		CORE EXCHANGE			25.00	25.00

Genuine GM Parts

LER JEEP DODGE and SATURN parts — PARTS 134.86

Figure 18



GETTING STARTED ON NO START COMPLAINTS

TIPS ON MAKING AN 'EASY' PROBLEM TO FIX EVEN EASIER.

BY **PETE MEIER** | TECHNICAL EDITOR

Trying to diagnose a minor glitch in engine performance, especially when there are no Diagnostic Trouble Codes (DTCs) to provide some type of guidance, is one of the tougher challenges a drivability tech faces. On the opposite end of the spectrum is the no start complaint. This should be one of the easiest to figure out, shouldn't it?

Yet for some, this is as tough a troubleshooting chore as any other. And it all usually centers on two things: lack of system knowledge and lack of a logical process. Ready to improve both?

Open Up The Funnel

A common mistake is to jump to conclusions as to what the cause of a problem might be. These assumptions often result in a case of tunnel vision that prevents even the best of techs from reaching a successful conclusion. Ever find yourself under the hood, scratching your head and pondering what possibly could be wrong, only to have a co-worker come over and spot the problem in seconds? "Can't see the forest for the trees," is a good saying to keep in mind when starting off your diagnostic quest.

To avoid this, consider every potential cause as suspect. With perhaps dozens (if not more) of possibilities, it becomes evident that you need a process that will help you sort through them all in as efficient a manner as possible. That leads me to the next common mistake I want to discuss: testing without purpose.

Any test you make on a vehicle system should be performed with an end result in mind. The first task at hand is to thin that list of suspects as much as you can, and that calls for a general procedure that covers a lot of territory in one, easy as possible to perform, test. You might follow your first general test with a second or even third to reduce that list of suspects to a more manageable size. Once done, you can focus on each of the remaining possibilities using more precise, or pinpoint, tests to isolate the root cause of the problem.

Instead, many of us tend to dance around. We perform a general test, then a pinpoint test and then we back up with yet another general test. We test whatever comes to mind first, hoping we'll stumble on the answer. Often, the result is that we pass right by it without even realizing it. Let's apply all this to a typical no start complaint.

What Kind Of No Start?

In my reality, no start complaints usually arrive at the shop on the back of a tow truck or already are waiting in the lot having been towed in while the shop was closed. It certainly isn't unusual to see nothing more than the words "No start" written on the work order and not much else. At this point, every possibility under the sun should be suspect.

Photos: Pete Meier

PARTS PAYOFF –
FRICTION, A/C AND COOLING

O'Reilly PARTS PAYOFF

FIRST CALL ONLINE®

Earn a $25 gift card for every $1000 in Friction, A/C and Cooling product purchases!*

IT'S EASY TO PARTICIPATE!

Now through August 31 earn more for your Friction, A/C and Cooling jobs! All you need to do is enroll in the Parts Payoff program and purchase the same trusted friction and cooling brands you always have. The rest of the work is done for you! With your purchases automatically tracked and quick enrollment, it's easier now to earn more!

*Limit 4 gift cards per account, per promotional period. See FirstCallOnline.com for additional information.

EARN WITH THESE FRICTION, A/C & COOLING BRANDS

WAGNER® · BRAKEBEST · BRAKEBEST SELECT · Gates® A Tomkins Company · IMPORTDIRECT™ OE REPLACEMENT PARTS · VDO · MURRAY TEMPERATURE CONTROL · MASTERPRO BELTS & HOSES

YOUR MOST TRUSTED TOOL MAY NOT BE IN YOUR TOOLBOX

CHECK OUT THE NEW AND IMPROVED FIRST CALL ONLINE

IMPROVED SEARCH FUNCTION,
EASIER ORDERING, AND ADDED FEATURES.

O'Reilly® AUTO PARTS

FirstCallOnline.com

FIRST CALL® O'Reilly AUTO PARTS

Pete Meier always tells techs to "Test, don't guess." Find out why that's the case in this story. MotoAge.com/dontguess

A no start condition can be broken down into two general types: an engine that won't turn over and an engine that cranks but will not run on its own. I can perform a quick, easy general test to isolate which variant I'm dealing with.

First, I turn the key to Start and try to start the car. In this case, the engine's starter motor engages normally and the engine spins over at a normal cranking speed but does not run or even make the attempt to start running.

Troubleshooting is not a matter of only science and measurement. Every sense you have plays a role. Can you hear the starter motor engage? Do you smell fuel? Do you see any reading on the tachometer as the engine is spinning? Do you feel the engine spinning over normally? These are only a few examples of the information you should be taking note of while you are verifying this customer's complaint. Are you actively aware, though, of these things when you're faced with a no start diag?

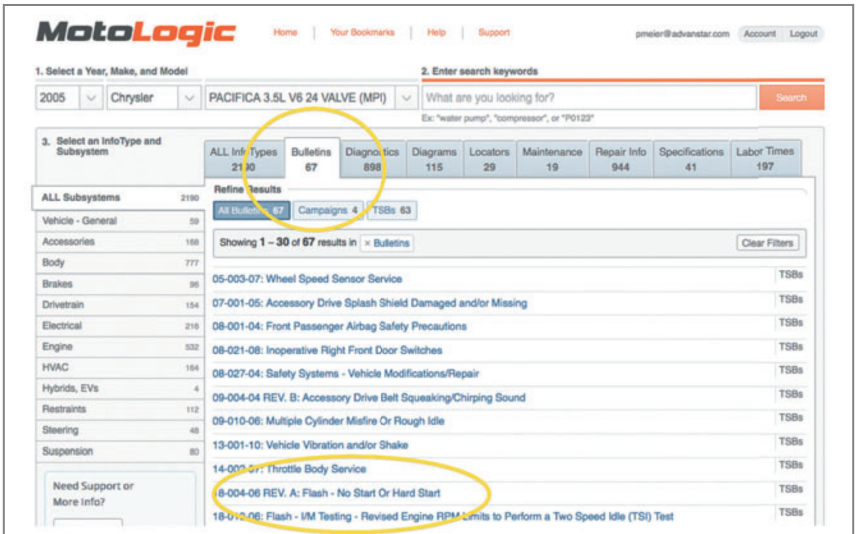
The key turn is the first general test and noting what happens, in as much detail as you can, is the collection of the test results. After you have the results, it's time to apply them logically to the list of suspects and narrow the field. From there, you can decide if another general test is needed to trim the selections even further or if you can move to a pinpoint test to pin down the culprit.

Is it necessary to test the battery or starting system based on our first general test? Of course not. The engine engaged and turned over at a normal speed. Cranking it over is not the issue. Yet some of you do exactly that, burning time and getting no closer to the cause.

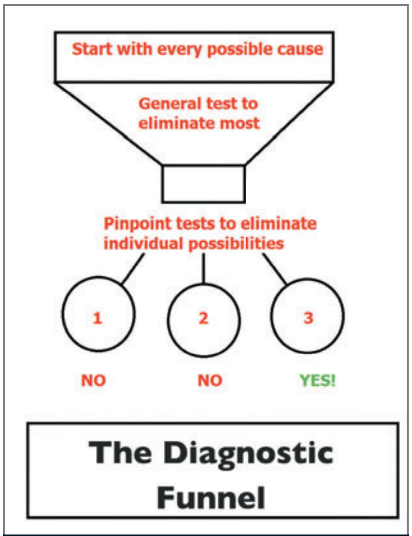
Do I suspect any mechanical issues with the engine? Sounds like a reasonable question. If the engine were binding it may not turn over at all, but I would have heard that in the tone of the engine as I tried to crank it over. Perhaps there is a loss of compression that is preventing the engine from starting. After all, an engine needs three things to run: compression, fuel and spark. But again, wouldn't I hear that in the tone of the engine while cranking?

Who said "antitheft"? Possible, but that usually allows a car to start and run for a few seconds before dying and/or indicate that the system is activated with a little flashing light on the dash.

OK, I heard that. Somewhere way in the back. Who asked if there was an rpm reading on the tachometer while the engine was spinning?



Once you've confirmed the type of problem you're chasing, check your service information provider for any related bulletins or recalls.



Every potential cause is suspect in the beginning. Use general tests first to narrow down the list of suspects, then pinpoint testing to isolate the root cause.

Moving Onward

As it turns out, there was no movement of the needle on the tachometer while the engine was spinning. On many vehicles, the loss of the Crankshaft Position Sensor (CKP) can prevent the vehicle from starting. Because this same sensor often is the source of any rpm signal used by the instrument cluster, the lack of needle movement could indicate a problem in the CKP or its circuit.

Would you perform a general test or a pinpoint test next? I vote for a pinpoint test using a scan tool to focus on that suspect CKP.

Specifically, I'm going to see if there are any codes stored related to the CKP sensor. But I'm not going to be surprised if there aren't any. It is not unusual for the Engine Control Module (ECM) to miss a crank sensor failure. Do you know why? Depending on the programmed testing strategy (which you can learn


A spark test is a general test that can help you home in on the cause of a "cranks, no-start" complaint.

Photos: Pete Meier

GENUINE KIA PARTS

True. Dependable. Genuine.

Kia vehicles are at the forefront of today's technological engineering. Unique components in our Kia vehicles demand precise engineering and fit. Kia customers deserve Genuine Kia replacement parts to keep them satisfied for years to come. Our brand's popularity continues to grow meaning more Kia customers for your shop. Always specify Genuine Kia Parts for the highest level of fit, function and quality.

Contact your local Kia dealer today for assistance and delivery of your parts.

KIA | Genuine Parts

Nationwide

100% PARTS & LA

A/C REPAIR KITS

AutoZone carries a complete selection of high-quality A/C service parts, tools and chemicals. And, when you purchase an A/C kit (compressor, drier/accumulator and expansion device on the same invoice), we'll back them with a 100% parts & labor reimbursement guarantee.* Make AutoZone your first call every time!

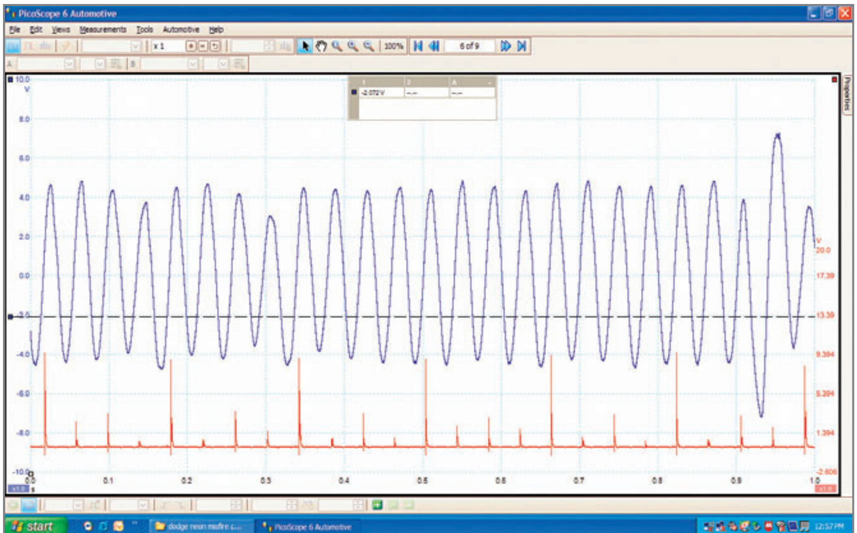
Order from your Commercial Sales Manager, at www.autozonepro.com, through your shop management system or by phone.

BOR GUARANTEE

AutoZone®

GOING THE EXTRA MILE℠

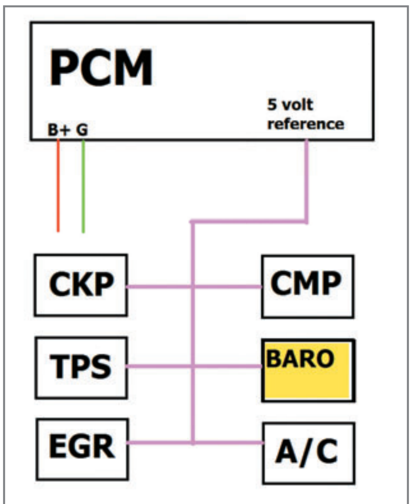
*Reimbursements will be made in accordance with AutoZone's policies. Excludes VDP or Outside Buys. 48 hour labor claim response guarantee does not apply to claims over $1,000 or claims requiring product testing. Valid for commercial customers who are in good credit standing only. Program subject to change without notice. Contact your AutoZone Commercial Specialist for details.



A scope is an excellent tool for both general and pinpoint testing.

more about by reading up on theory and operation in your service information system and/or by reading the conditions/criterion for setting a CKP failure code), when the CKP sensor signal is lost, the ECM simply thinks the engine has shut down.

I'm also going to take a look at live data with a particular interest in what the CKP Parameter Identifer (PID) is reporting. While this signal might be the source of the rpm reading at the instrument cluster, that signal could be taking the long way there through other modules on the network. I want to know specifically what information, or lack of information, the ECM is receiving.



Typically, the loss of a reference voltage is caused by a shorted sensor on the reference line. Unplugging the faulty sensor usually restores the 5-volt supply to the others.

Accessing codes first, I do indeed find a CKP circuit fault code stored in the ECM's memory. In addition to the CKP code, though, are similar codes for the Camshaft Position Sensor (CMP), Throttle Position Sensor (TPS) and Barometric Pressure Sensor (BARO), all defined simply as "circuit fault." Not the test results I expected, but with this information it wasn't necessary to continue any further with the scan tool.

A Change In Direction

When I began this test on this 2005 Chrysler Pacifica, my purpose was to verify my suspicions that the CKP sensor was the culprit. But the presence of additional sensor codes was a test result that altered that original hypothesis. The CKP sensor still was on my list of potential causes, but now I had one more to add. One, I thought, would shortly prove to be the root cause of the problem. One that one more pinpoint test would verify.

With this many similar codes stored, isn't it logical to consider what they have in common? At this point, you might find yourself returning to the service information and doing a little homework. Pulling up the Engine Performance wiring diagram, it was easy to see that all of these sensors share a 5-volt power supply fed to them by the ECM. This is their "Reference" voltage and without it, no signal could be sent back to the ECM.

The pinpoint test I next needed to perform was to see if the sensor supply voltage was present. Because the TPS sensor was the easiest to access,

Avoid tunnel vision when doing your troubleshooting. It might cause you to pass right by the culprit and not even know it.

I backprobed the appropriate wire in the TPS connector and measured the voltage present with my Digital Multimeter (DMM). I read 0.31 volt.

Now I know what the root cause is. No reference voltage to the sensors critical to the operation of the ignition and fuel injection systems. The remaining question to repairing the problem is figuring out why.

Typically, when a loss of reference voltage is experienced, a shorted sensor on the 5-volt line is the cause. This also is easy to find. Simply monitor the reference voltage while you unplug the sensors sharing the line. How do I know that? I read the theory and operation of the system I am troubleshooting, related Technical Service Bulletins (TSBs) and continue to educate myself and grow my skills.

In this case, the first to be unplugged was the TPS sensor location I started with. No change. The next easiest to access was the BARO sensor. Unplugging that sensor immediately restored the 5-volt reading I was looking for on my meter. Because I didn't need the BARO sensor to start the engine, a quick turn of the key followed by the immediate start of the V-6 powerplant verified the problem was found. 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.

Email Pete at pmeier@advanstar.com

TIRE EQUIPMENT SALE

Save now and turn a profit

$2,620

DST64T / Digital Wheel Balancer
Max. tire diameter: 50"
Wheel width capacities: 1.5"- 20"

*FREE SHIPPING

$1,510

R745 / Tire Changer
Internal clamping: 12"- 21"
Max. tire diameter: 36"

$3,215

R30XLT
Power Assist Tire Changer
Internal clamping: 13"- 33"
Max. tire diameter: 50"

$11,245

CRT380R / Wireless Wheel Aligner
Cordless Bluetooth® sensors
Front and back axle readings

$5,130

RL-8500 / Combination Brake Lathe
Services rotors and drums
Includes bench and tooling

$1,595

TS-150 / Tire Spreader
Full pneumatic power supply
Max. pressure: 125 -175 psi

$8,650

RB24T / Super-Duty Truck Balancer
Max. tire diameter: 50"
Max. tire weight: 400 lbs.

$1,555

DST2420 / Wheel Balancer
Max. tire diameter: 47"
Max. tire weight: 145 lbs.

**HURRY! These prices won't last

$6,055

R26FLT / Super-Duty Truck Tire Changer
Max. tire diameter: 63"
Max. tire width: 31.5"

$2,655

R23AT / Tilt-Back Tire Changer
Internal clamping: 11.5 "- 24"
Max. tire diameter: 41"

$1,855

R980XR / Swing-Arm Tire Changer
Internal clamping (inner): 13"- 25.5"
Max. tire diameter: 50"

1-800-253-2363 • www.bendpak.com/purchase
Contact your local BendPak/Ranger dealer for details

*FREE SHIPPING

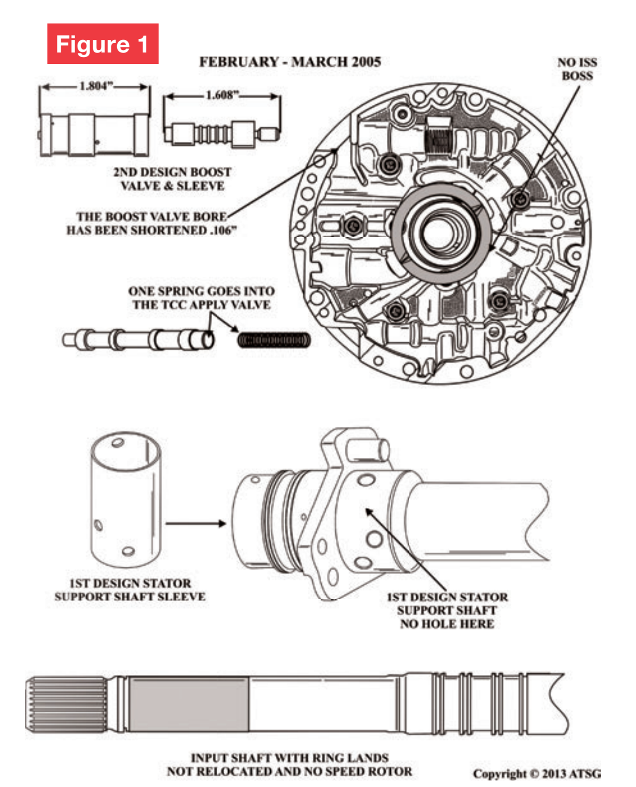
*Free shipping on all BendPak and Ranger Products to most areas in the 48 contiguous states.
**Valid at participating dealers. Prices subject to change after September 30, 2013

Ranger PRODUCTS

POWERTRAIN PRO

ATSG TIPS

ADDING UP PUMP & INPUT SHAFT USAGE



MANY COMPLAINTS ARE ASSOCIATED WITH ONE CAUSE. FOLLOW THESE STEPS TO FIX THEM.

BY **WAYNE COLONNA** | POWERTRAIN PRO PUBLISHER

Let's look at when DTCs P0716 and P0717 may be stored, there is no torque converter fill, are burnt frictions in the input drum, is planetary gear set destruction or TCC application problems.

Incorrect interchangeability practices of pump covers and input shafts. At the start of 2006 MY production, an Input Speed Sensor was added to some 4L60/65/70E transmissions. This necessitated changes to the pump cover and input shaft.

The ISS signal is an input to the control module (PCM or TCM) that will be used to better monitor and control line pressure, shift patterns, torque converter clutch slip speed and gear ratios. This component allows the 4L60/65/70-E transmissions to enable use of computer instructions related to shift energy, and abuse torque management and provide improved diagnosis.

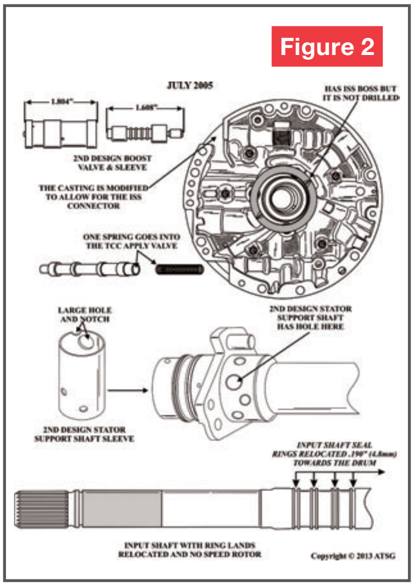
The new turbine input shaft speed sensor was gradually phased into production, and certain design level criteria had to be followed. Here is a general outline of implementing the use of the ISS.

1. In MY 1997 to early 2005, the 4L60E series transmissions utilized a pump cover with no provisions for an ISS, the input shaft sealing ring grooves had not changed and there was no speed sensor rotor. The pump cover used the 1st design internal stator shaft sleeve and the 1st design boost valve which is 1.664 inches with a boost valve sleeve of 1.910 inches in length as well as two springs that went on the TCC apply valve.

2. Effective Feb. 1, 2005, the oil pump cover now uses a new design TCC valve with a single spring (Figure 1).

3. As of March 7, 2005, the oil pump cover uses a more compact boost valve and sleeve. The snap ring groove location for the boost sleeve is 2.57 inches from the bottom of the bore compared to 2.68 inches for the previous design. The bore length for the boost sleeve and snap ring was reduced by approximately 0.110 inch (Figure 1).

4. After July 16, 2005, the pump cover casting was modified in order to situate the ISS connector. This modification removed metal directly below the PR valve and boost sleeve bore and extended a cast wall inward. The internal TCC release passage was also modified. The ISS mounting holes are not yet machined into the oil pump cover (Figure 2).



Photos: Wayne Colonna

Figure 3

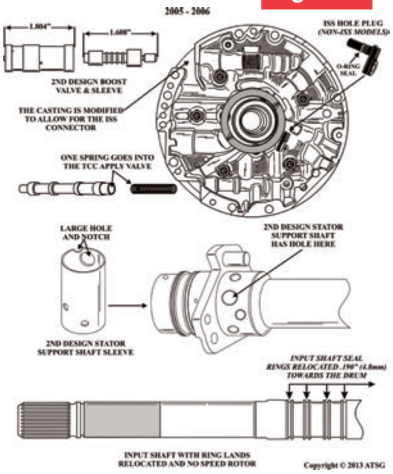
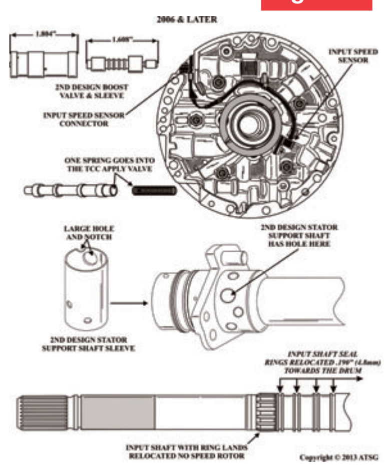


Figure 4



5. Late in 2005 and early in the 2006 MY, some pre-ISS models still may not have the ISS mounting holes machined into the cover. This will be evident as a smooth un-machined surface without the ISS mounting holes. For non-ISS models, an ISS hole plug will be used in place of the ISS assembly (Figure 3).

As ISS models were introduced, later in the 2006 model year, the machining took place and the input speed sensor (ISS) was added, the presence of the ISS also necessitated a new internal wire harness to accommodate the ISS and software changes to the PCM provided code capability for ISS malfunctions.

As ISS models were introduced, later in the 2006 model year, the machining took place and the input speed sensor (ISS) was added (Figure 4), the presence of the ISS also necessitated a new internal wire harness to accommodate the ISS and software changes to the PCM provided code capability for ISS malfunctions.

On non-ISS models with a functional ISS hole in the pump cover, the rubber plug with an O-ring seal must be installed. Failure will result in no converter charge and the vehicle will not move. If an input shaft is used without the speed rotor, and the pump cover has an ISS, codes P0716 or P0717 will be stored, which may cause TCC slip and gear ratio calculation errors. If the pump cover and input shaft are mismatched, there will be severe friction and geartrain damage.

Also, parts you find in a particular transmission might not coincide exactly with the published phase in time periods. Dates listed are for general purposes.

Oil pump cover changes also affected the stator shaft and stator shaft sleeve so as to relocate with oil passages within the oil pump cover. At the same time, the turbine shaft oil seal ring grooves were moved inboard towards the rear of the unit 0.190 inch to produce an area with which to manufacture 15 rotor teeth (Figure 2). MA

RANSHU

WE WILL SHIP
UNTIL 6 PM

OPEN M-F
6 AM-6 PM

13-7

800-628-0474

KIA 04-06 AMANTI 3.5L HS-18 14-0144NC $189.00	HONDA 1995-97 ACCORD 10PA17C 14-2789NEW $150.00	GM CARS CADILLAC H6 14-20177NEW $180.00	FORD 05-07 FIVE HUNDRED SCROLL 14-0171NEW $180.00	NISSAN 1998-02 2.4 FRONTIER DKV14C 14-3137NC $240.00	VOLKSWAGEN 1994-98 GOLF/JETTA W/6 GV 14-2828NEW $210.00	TRACTOR CATERPILLAR SANDEN W/24V 14-SD4604NC $270.00

KIA 06-09 SEDONA 3.8L HS20 14-0632NC $297.00	HONDA CIVIC 1992-00 NEW IMPORT $150.00	GM CARS V5 15-20343 14-20343NEW $159.00	FORD 03-04 FOCUS 2.0 DOHC FS-10 14-4465NC $186.00	NISSAN 04-07 ARMADA DKS17D 14-0177NC $180.00	VOLKSWAGEN 98-05 BEETLE SD7V16 14-3659NEW $210.00	PETERBILT DOUBLE GROOVE SANDEN 4696 14-SD4696NEW $150.00

KIA 98-02 SPORTAGE 1GV 10PA15C 14-2820NEW $159.00	HONDA 03-07 ACCORD 4CYL 10S17C 14-0155NEW $198.00	GM TRUCK 2000-04 FULL SIZE 10S17F 14-21177NIP $240.00	FORD 2002 4.0L EXPLORER SANDEN 14-0089NEW $174.00	NISSAN 01-04 FRONTIER W S/C DKV14C 14-0176NEW $231.00	VOLKSWAGEN 98-05 PASSAT 2.8L 7SB16C 14-2953NEW $231.00	STERLING W/SANDEN 7804 W8 GROOVE 14-SD7804NC $297.00

KIA 04-06 SPECTRA 5 10PA15C 14-0257NC $240.00	HONDA 03-09 ELEMENT 10S17C 14-0202NEW $231.00	R4'S 14-20185NEW $159.00 14-20189NEW $159.00 14-20206NEW $159.00	FORD/ MAZDA PROBE AND 626 94-97 NEW PANASONIC 14-2905NC $330.00	NISSAN 96-99 PATHFINDER 3.3L CWV618 14-2974NEW $210.00	VOLKSWAGEN 04-07 TOUAREG 7GRV 7SEU16C 14-0179NIP $450.00	FORD TRUCK SANDEN 4718 W/ 8 GROOVE 14-SD4718NC $270.00

KIA 00-02 RIO HS 15 14-7001NC $180.00	HONDA 06-09 CIVIC TRSEO7 14-0706NC $390.00	CAVALIER 2002-2004 CVC 14-21198 $270.00	FORD FS10 1992-01 RANGER 1990-97 F SERIES 14-2735NEW $132.00	NISSAN 2001-04 FRONTIER 3.3L DKV14C 14-4008NEW $210.00	VOLKSWAGEN 06-09 RABBIT PXE16 14-0378NEW $297.00	TRUCK YORK CLUTCH AVAILABLE 14-2125NEW $159.00

KIA 03-06 SORENTO HS-17 14-7004NC $210.00	HONDA 06-07 RIDGELINE 10S20C 14-0241NEW $198.00	CADILLAC DEVILLE 2000-2005 MSC130 14-20412NEW $240.00	FORD 2002-05 THUNDERBIRD SCROLL 3.9L ENGINE 14-0025NEW $180.00	NISSAN 1993-4 SENTRA 2.0L DKV14D 14-2806NC $315.00	VOLKSWAGEN 00-05 GOLF/JETTA SD7V16 14-4023NEW $189.00	FREIGHTLINER SANDEN 4418, W/ 8 GROOVE CLUTCH 14-SD4418NC $300.00

KIA 02-05 SEDONA FS10 14-7002NC $210.00	HONDA 03-04 PILOT 10S20C 14-0071NEW $198.00	GM TRUCK 1996-00 C AND S HT6 14-20151NC $240.00	FORD HR980 W/ 1GV, 2GV OR 6GV VARIOUS $225.00	NISSAN 02-04 ALTIMA 2.5L DKS170 14-0072NC $270.00	VOLKSWAGEN 06-09 PASSAT 3.6L PXE16 14-0285NC $297.00	KENWORTH SANDEN 4667 W/ 8 GROOVE CLUTCH 14-SD4667NC $240.00

RANSHU.COM

SIGN UP FOR RANSHU'S BIWEEKLY TECH TIPS AND EMAIL SPECIALS AT RANSHU.COM/EMAIL. YOU WILL GET GREAT TIPS TO HELP HOLD DOWN REPAIR TIMES AND WARRANTY RATES PLUS UNBELIEVABLE SPECIALS.

JOHN DEERE 8 GRV 12V 10PA17C 14-0076NC $270.00	SATURN 2002-03 VUE 3.0L SCROLL 14-0169NEW $240.00	KENWORTH SANDEN 4042 W/ 8 GROOVE CLUTCH 14-SD4042NC $210.00	SANDEN 8390 R12 FLARE 14-SD8390NEW $150.00	INFINITI 98-01 Q45 CWV618 14-4018NEW $210.00	ISUZU 02-05 RODEO DKV14G 14-0053NC $315.00	ACURA 01-03 CL 10S17C 14-0049NEW $165.00

JOHN DEERE 8 GRV 24V 10PA17C 14-0413NC $270.00	SATURN 1999-02 SC & SL DCV11G 14-3167NEW $270.00	VOLVO GM SERIES 60 SANDEN 2 GRV 14-SD4699NC $240.00	SANDEN 5017 R12 PAD 14-SD5017NC $189.00	INFINITI 01-03 QX4 CWV618 14-4009NEW $210.00	ISUZU 03-07 ASCENDER 4.2L TRSA12 14-SD3450NEW $189.00	ACURA 98-99 CL 10PA17C 14-0022NEW $189.00

JOHN DEERE 8 GRV 12V 10PA15C 14-0054NC $270.00	SATURN 2004-07 VUE 2.2-2.4L SCROLL 14-0286NEW $240.00	PETERBILT SANDEN 4039 W/ 6 GROOVE 14-SD4039NC $210.00	DIESEL KIKI TM-15 2 GROOVE 12V ORING 14-DK25011NC $189.00	INFINITI 2000 QX4 CWV618 14-4016NEW $210.00	ISUZU 89-92 AMIGO DKS13S 14-2690NC $240.00	ACURA 90-01 INTEGRA 10PA15C 14-2781NEW $180.00

JOHN DEERE SINGLE GRV 12V 6E 171 14-0085NEW $231.00	SATURN 2000-04 L SERIES 2.2L DCV14J 14-4027NC $420.00	MOTORHOME SPARTAN W/ 8GRV 12V 14-SD4420NC $189.00	SANDEN 7 GROOVE R12 ORING 14-SD9537NC $189.00	INFINITI 99-01 I30 CWV618 14-0078NEW $231.00	ISUZU 04-06 i280, i350 10S17C 14-21197 $315.00	ACURA 91-95 LEDGEND 10PA20C 14-2783NEW $210.00

JOHN DEERE SINGLE GRV 24V 10PA17C 14-0272NC $270.00	SATURN 2000-05 L SERIES 3.0 COMPRESSOR KIT 14-0114KIT $297.00	PETERBILT W/3406 DIESEL SANDEN 6 GRV 14-SD4040NC $210.00	SANDEN 4628 FORD BOLT PATTERN ORING 14-SD4628NC $189.00	INFINITI 96-99 I30 CWV618 14-0031NEW $210.00	ISUZU 96-99 OASIS 10PA17C 14-0096NC $240.00	ACURA 02-06 RSX HS090R 14-0122NEW $174.00

JOHN DEERE 8 GRV 12V 10PA15C 14-0275NC $297.00	SATURN 2004-07 ION 2.0L CVC 14-21589 $360.00	FREIGHTLINER SANDEN 4417 W/ 8 GROOVE CLUTCH 14-SD4417NC $210.00	DIESEL KIKI TM-16 2 GRV 12V 14-DK56021NC $189.00	INFINITI 96 I30 CWV618 14-2802NEW $240.00	ISUZU 93-97 RODEO 3.2L DKV14D 14-2965NEW $210.00	ACURA 04-08 TL 10S17C 14-0164NEW $198.00

JOHN DEERE SINGLE GRV 24V 10PA15 14-0205NC $297.00	SATURN 2002-03 VUE 2.2L SCROLL 14-0291NEW $240.00	AFTERMARKET MH SANDEN 4646 W/ 2 V GROOVES 14-SD4646NC $210.00	DIESEL KIKI TM-16 8 GRV 12V 14-DK56121NC $189.00	INFINITI 04-07 QX56 DKS17D 14-0177NC $180.00	ISUZU 89-91 TROOPER 3.2L R4 14-20227F $174.00	ACURA 04-08 TSX HS110 3 WIRE 14-0331NEW $240.00

IN THIS SECTION

read it on MotorAge.com

BRAKES & ETHICS
We talk about brake fixes this month, but your ethics need to be in line, too.
/brakeethics

EFORUM TOPICS
Some companies shared their concerns about connected vehicles.
/eforumtalk

SILENCING BELTS
New Dayco product delivers on promise to silence squeaky serpentine belts.
/squeakybelts

ELECTRICAL

READING A SCHEMATIC

Before you start randomly probing the harness, take the time to plan your route using the electrical road map, the schematic.

READING AN ELECTRICAL MAP MEANS LITTLE IF YOU DON'T KNOW HOW TO DRIVE.

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

Wiring diagrams are like road maps. You wouldn't take a cross-country trip without consulting a map or a GPS, would you? But many techs will dive blindly into an electrical diagnosis without first consulting the schematic.

Unfortunately, wiring schematics don't come with a GPS navigation option. (The one neat exception I've seen is the OEM Mazda diagrams in MotoLogic. They are interactive and show current flow in the circuit under different key positions.)

No, for the most part we have to do it the way techs have been doing it for years. And you'll find it isn't all that difficult if you read through and follow all the steps. Just like reading a road map, the first place to start is with the diagram information, providing you with the position, arrangement of devices and terminals. OE diagrams often are all-inclusive, that is they show everything on one big diagram that is broken up into segments. Most aftermarket service information providers provide simpler diagrams, referred to as block diagrams, that show only the components/wiring needed by an individual circuit. Most block diagrams also start with the power source at the top of the page and follow the path to ground, ending at the bottom of the page. This is followed by a color code chart, so you'll know what colors the diagram abbreviations are referring to.

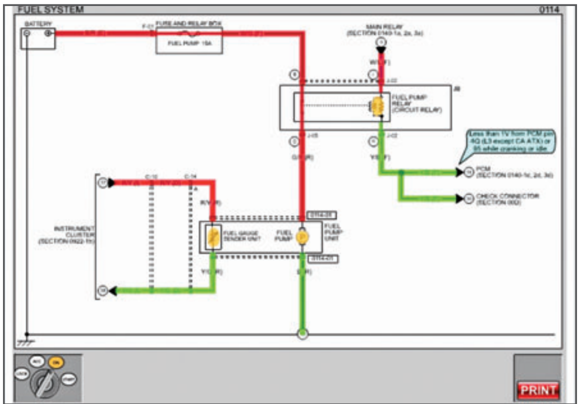
Think that is too simple? Check out an OEM German schematic where all the colors are listed in Deustch! Next is the abbreviations list that will clue

JUST SCAN IT

Scan this QR Code to learn more about how to read a schematic. Or visit MotorAge.com/schematic

GET A FREE SCAN TOOL APP AT: www.scanlife.com

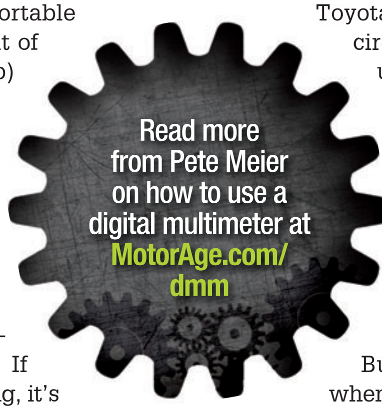
Photos: Pete Meier



This Mazda OEM diagram (taken from MotoLogic) highlights power and ground paths for you, depending on the key position you select.

you in on what the component abbreviations stand for. Last, but not least, review the symbols that will be used in the diagrams so you understand what they mean.

Once you're comfortable with the basic layout of the schematic (map) you're using, it's time to locate the specific address you want to investigate. On a wiring diagram, that would be the electrical component, or load, that is giving you a problem. If that load isn't working, it's because it has an internal problem or the current flow isn't flowing the way it should. That means we need to identify the basic elements the load needs to operate: the source of power, the control(s) that determine when the load is on and the path that connects it all together.



If you are not as comfortable with tracing wiring diagrams as you'd like to be, I would recommend you Google "Wiring Diagram Color Coding by Jorge Menchu." Menchu has been teaching wiring diagram color-coding seminars for years and offers his resources at AESWave.com.

In his seminar, he covers the basics that many have missed in our industry. Menchu explains how to color code the wiring diagram in five basic parts using red to represent power all the time, green as grounds all the time, orange as power only when the circuit (control device) is closed, yellow as ground only when the circuit (control device) is closed and blue as a variable voltage. Most electrical faults can be found easily when you know what test results to expect, and Menchu's method of color-coding helps you do just that. I'd also recommend you visit the *Motor Age* website and read The Electrical System Roadmap article in the February 2009 issue.

Something To Get You Going

For an example of how to get started improving your wiring diagram navigational skills, I'm going to use a typical block diagram schematic of a 2007 Toyota Corolla CE headlight circuit and show how to use it to troubleshoot a missing driver's side low beam. If you're typical, the first thing you'd do is replace the bulb. Hey, I would have done the same thing. And most of the time we'd probably be right. But what would you do when the new bulb also fails to work?

Go make a copy of the diagram and follow along.

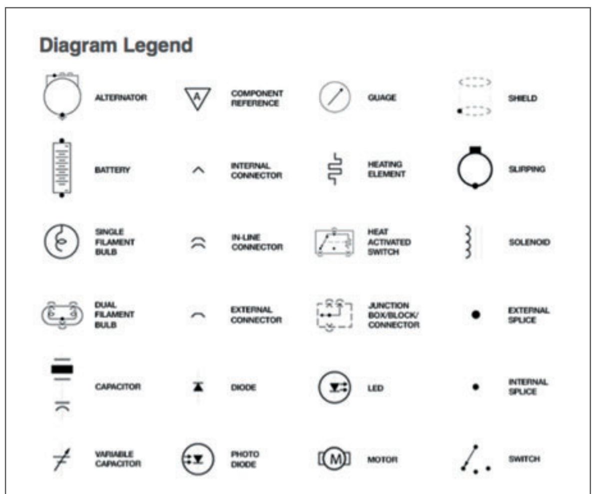
Lots of stuff on this diagram, isn't there? Don't freak out quite yet. You already know that every electrical circuit has to have certain basic elements in order to work. The first thing we need is a load, or component that will do the job we want the circuit to perform. What other reason would we have for wiring stuff in? In this case, it's the headlights, so let's find them first and give them a little color so we can find them again easily.

With the load identified, it's time to move on to what that load needs to work: power and ground. The object of the next step is to locate and identify the wires at the load that supply both. In this case, there are only two wires to choose from, so we've got a 50/50 shot. Seriously, though, in those cases where the load has more than two wires, just pick one and start following it to see where it goes.

I'm going to start with the one on top. In block diagrams, power wires generally head up the page while ground wires generally head down. This might not always be the case, and it doesn't really matter. Like I said, I've got a 50/50 shot. This red wire with a white tracer (that is, a stripe that runs the length of the wire) first enters the fuse box where a 10-amp fuse provides the protection against shorts to ground for this circuit. A fuse will be located only on the power side of the load so I know what side I'm tracing now.

It's also easy to see that just past the fuse, the power feed to the other headlight is spliced in. The two bulbs might have separate fuses, but they share the same power source. Onward and upward.

The red trail now changes from one with a white tracer to one with a black one. The path leads to the headlight relay, and by the look of the relay symbol, it's on the switch side of the relay. What does that make the relay?



Just like reading a road map, you need to know what these symbols stand for to understand what "town" you're in.

Illustrations: MotoLogic

Sign up today!

DENSO
first time fit®

Who rewards you for installing DENSO Wiper Blades?

DENSO DOES

And earning **DENSO** rewards just got easier!

1 BUY

2 CLAIM

3 EARN

MY DENSO REWARDS

DENSO Wiper Blades. We have contact! You get the points.

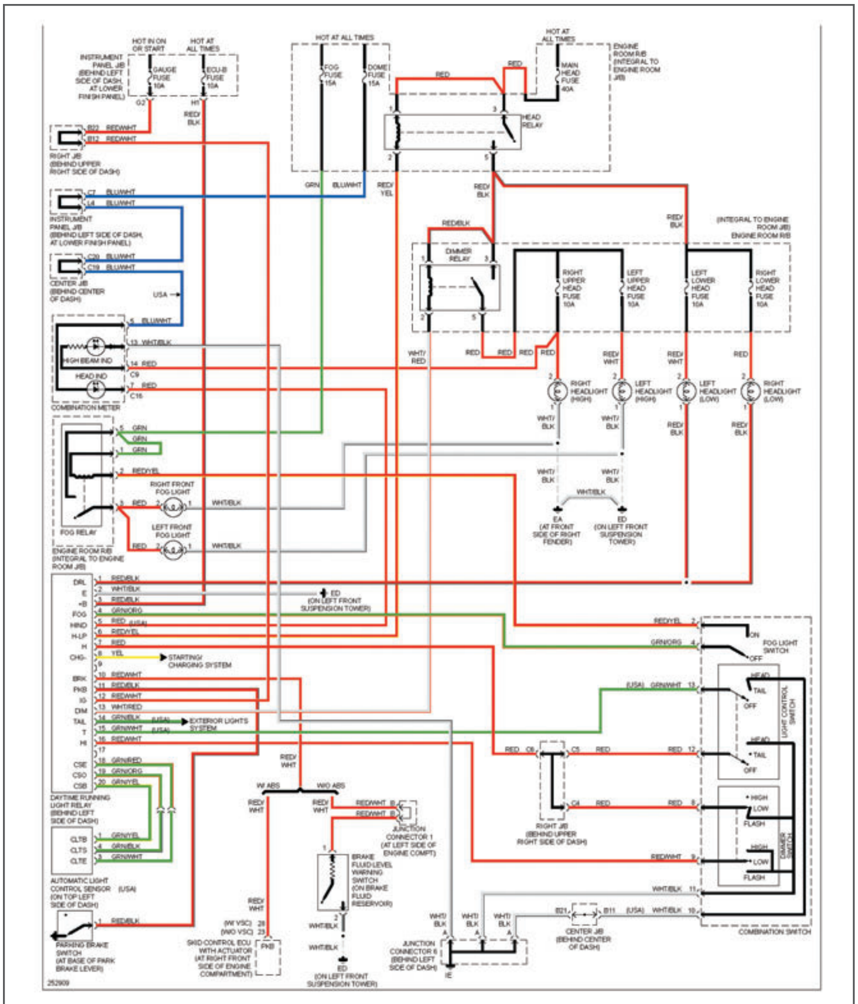
In an effort to reward DENSO professional technicians for their hard work, DENSO has unveiled a sales incentive program for shop owners and their technicians. This new incentive program is called My DENSO Rewards. The program runs through November 30, 2013, with participants earning rewards points when they install First Time Fit® Wiper Blades. The program is for participants in the United States and Canada. Enrollment and full details are at www.MyDENSOrewards.com

Scan with your smartphone to learn more

Know Your Parts® AASA

Be Car Care Aware™

You Tube



This is the schematic of a Corolla headlight system. That's a lot of wire!

Control or Load?

A relay is an electrical component typically used by a control module to turn a high current load on or off. That means the relay can be considered a control device or a load all its own. In this case, we are on that part of the relay that acts as a switch and we would treat the relay as such.

Am I worried about the solenoid side of the relay at this point? No, not until I suspect the relay's not doing its job as a control device. Until then, I'll stay focused on finding the power source I'm looking for.

And we're almost there. The red path now turns completely red as we exit the relay on the other side of the contacts. From there, it's a short walk to the Main Headlight 40-amp fuse, and from there it ends with a notation that reads "Hot At All Times."

What does that mean? The source for the majority of automotive electrical systems is the battery. Eventually, that's were we want to end up. In most block diagrams, the notation Hot At All Times means this point in the harness is a straight line back to the battery. You can verify exactly how it gets there by referring to a diagram called the Power Distribution schematic. This shows every circuit protection device on the car, the route from the battery to the device, and all the circuits that device protects.

"Hot In Run," "Hot In Start" and similar phrases indicates the path back to the battery first goes through the ignition switch. You'll find the details for these routes in the Power Distribution diagram as well.

For our purposes, though, we have succeeded in identifying the power side of the load back to the source. On to the "Dark Side."

With one half done, let's go back to the headlight and find out how current passing through it makes it's way to ground. The only wire left to trace is … what, another red wire with black tracer? But didn't we already trace that wire up at the relay? We can't have two power wires going to the headlight, can we?

No, of course not. Just goes to show you that wire colors aren't necessarily unique to the one you have your hand on.

So let's continue. It doesn't take long to see that both low beams come together on this path. Joined, they both continue along to the Daytime Running Light Relay (DRL). Sure are a lot of wires coming off of this thing, aren't there?

I'm So Confused!

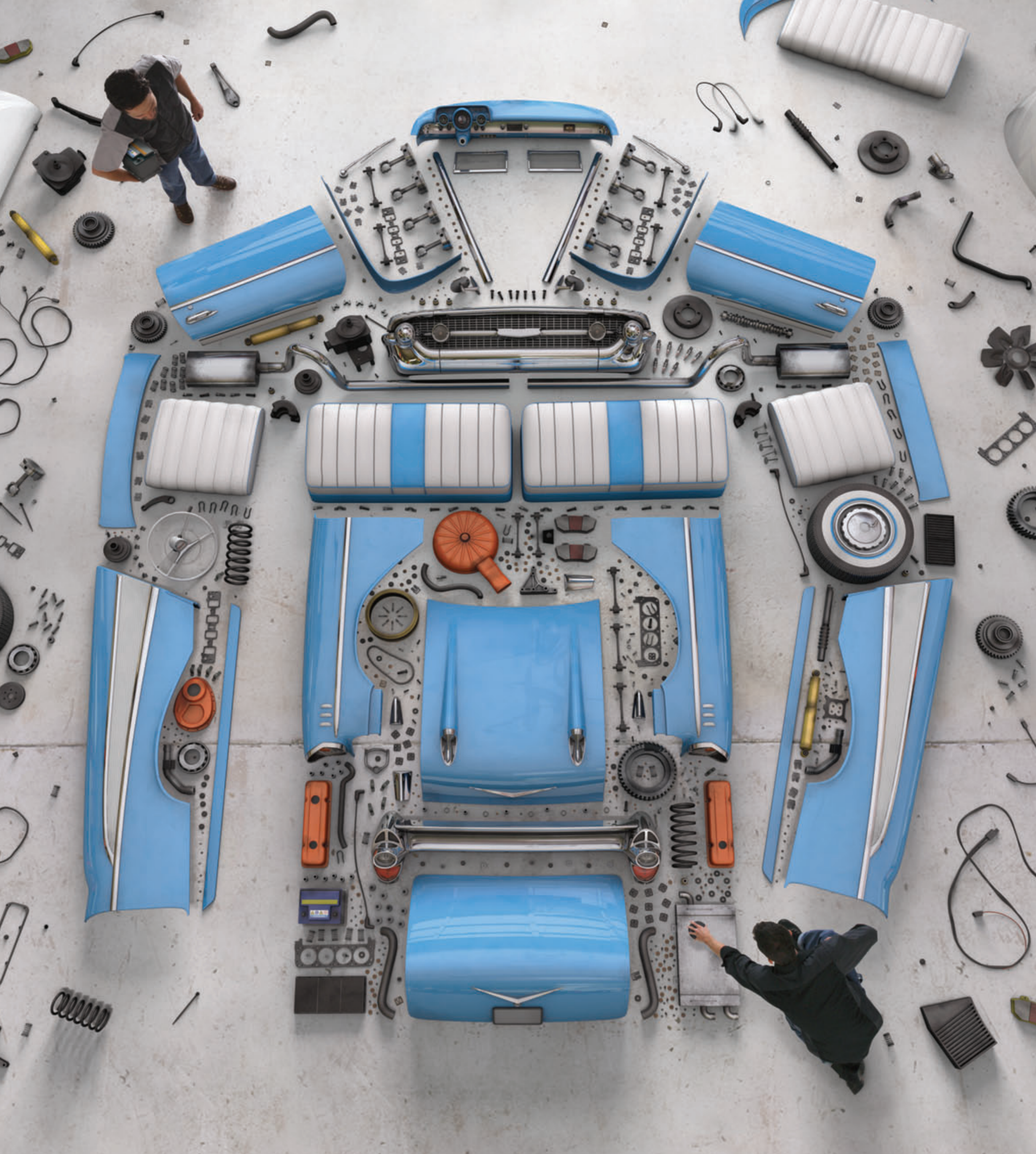
Here is where a lot of techs start to lose it. They find themselves tracing a diagram to a complex component on a wire they want to believe is one thing but the colors are telling them it's something else. Trust what you know. You'll find, as Menchu is fond of saying, that you know more than you give yourself credit for.

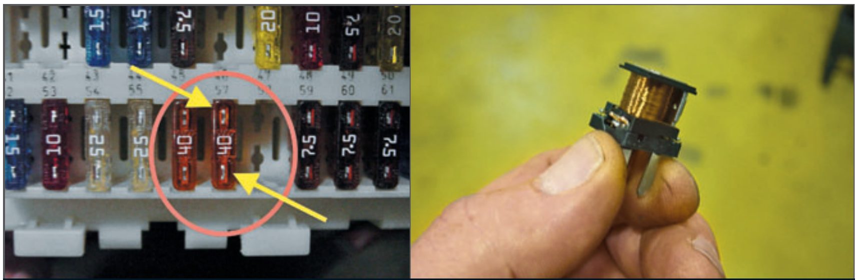
The red/black wire at the DRL has to be the ground path for the low beam headlights, doesn't it? With the complaint of only one low beam not working, do I care what the DRL does or how it does it? Think about that for a minute.

Both headlights share this part of the path, don't they? Anything that happens after the point where the two headlights meet would affect the operation of the both of them. And since we aren't having any problems with the right side, I'm going to focus only on that part of the schematic unique to the left one.

So which side has the problem? That's easy enough to find out. Turn the headlights on and measure for voltage with your multimeter at the red wire with white tracer. Take this measurement right at the headlight connector and ground your meter right at the battery. This makes sure you check the entire path you just traced on your diagram. Yes, I know I said I'm only concerned about that part of the wiring unique to the light, but testing the entire path is a best practice and a good habit to get into.

If there's no power, then there has to be a problem between the bulb con-





(Left) Test the fuse by checking for voltage at the probe points. A fuse can fail and still look intact. (Right) A relay can be a switch or a load, depending on what part of the circuit you are looking at.

nection and the point where the power feed splices together. The fuse would be the next easiest place to check. Just be sure to check it on both sides. I have seen fuses that looked fine on a visual check but were still open. No power there either? Only one stop left, and that's at the red/black wire that brings the power to the two low beam fuses.

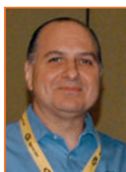
What if there is power? Then we move our multimeter lead to the ground side. If we read the same voltage here as we did on the power side with the lights turned on, there is an open circuit between the bulb and the ground splice point. If we read a perfect 0 on the meter, the bulb filament is blown or the bulb is not making good contact in the socket. No current is flowing. Any reading between the two over, say, 0.50 volt indicates excessive resistance in that short section of wiring, But if that were the case, the bulb would be lit, just dim.

And if Both Sides Worked?

You would still perform the same two tests, measuring the amount of voltage on both the power side and ground side of the bulbs as close to them as you can get. The only difference is where you would focus your efforts on the side with the problem. Because both bulbs are not working, you'd look only at those parts of the circuit the two have in common. You might even have to do some reading on how that DRL works, but it's a sure bet it completes ground somehow.

That's where your skill, training and experience come into play. Just like a good driver, you are comfortable with the idea of the basic operation of the system you're taking on. If not, you'll learn about that system first, won't you?

And that's what separates you from the amateur.



G. JERRY TRUGLIA
CONTRIBUTING EDITOR

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

Email G. at gtruglia@tstseminars.org


TONY & SONS
auto shop
REPEAT BUSINESS SHOULDN'T MEAN DOING THE SAME JOB REPEATEDLY.
For repairs that are right the first time, your best bet is an original equipment part. NTK Oxygen Sensors are original equipment on more vehicles worldwide than any other brand.
For details, go to NGKsparkplugs.com
Know Your Parts
AASA
Be Car Care Aware
Become a fan on Facebook
facebook.com/NGKSparkplugs
NTK
OXYGEN SENSORS
The World Leader

NOW YOU SEE IT, NOW YOU DON'T.

Smoke is a great diagnostic aid for many applications, including testing for intake air leaks.

WHAT TO DO WHEN THAT MIL ISN'T ON WHEN THE CUSTOMER FINALLY ARRIVES AT THE SHOP.

BY **PETE MEIER** | TECHNICAL EDITOR

Has this ever happened to you? A customer calls telling you that her car's Malfunction Indicator Lamp (MIL) is on and she's worried about what she needs to do. You ask if she's noticed any changes in the way the car drives and after her reply to the negative, you carefully explain that there are hundreds (if not thousands) of possibilities that could cause that Check Engine light to turn on. In her case, you tell her that it likely can wait until she can bring the car in at her convenience, and you schedule an appointment for later in the week.

This was on a Monday, and when she arrives Thursday morning she informs you the light is no longer on. Should she still have the car looked at?

A Personal Experience

I do a fair amount of traveling and left the end of this past March to attend the TST Big Event in Fishkill, N.Y. It was a chilly 50-odd degrees (chilly at least for us Floridians!) when my wife and I left for the airport.

Shortly after we started our drive, that annoying yellow warning light came on, catching my wife's attention. She (like many of your own uninformed customers) worried that we might break down on the way and miss our flight. Sensing no change in the way the car was performing, I assured her that I didn't believe that would happen, and we continued on our way.

After we returned a few days later, the MIL light was still on as I drove the car home. I had every intention in the world of connecting to the car and asking the Powertrain Control Module (PCM) what had upset it enough to trigger the light the next morning. But other duties called and the car sat, unattended to.

I'll be the first to admit that I have a great job. I get to travel the country meeting technicians and shop owners, write about fixing cars and work from home. With the year-round beautiful weather my home state has to offer, if I do need to run an errand in town, I usually prefer two wheels to four. The Toyota Corolla I own is called into service only when the weather takes a turn for the worse, spending most of its time idle in the driveway. And I admit, when it comes to servicing or repairing my personal vehicles, I tend to procrastinate as much as possible. So, it was several weeks before I actually took the time to finally connect my little pocket code reader to see why the MIL had come on.

Only now it wasn't on anymore.

> **JUST SCAN IT**
>
> Scan this QR Code to read on your smartphone a Motor Age Garage involving system lean codes. Or visit MotorAge.com/magcodes
>
> GET A FREE SCAN TOOL APP AT: www.scanlife.com

Here Today, Gone Tomorrow

An OBDII computer, like the one on the Toyota, conducts a variety of tests

Photos: Pete Meier

on itself, its inputs and outputs. When these tests fail and a problem is detected, the computer software generates an appropriate Diagnostic Trouble Code (DTC) and turns the MIL light on to alert the driver. If the Engine Control Module (ECM) test that triggered the light is passed later three times in succession, the ECM will turn the light off, but will keep the code active in its memory for a while longer (usually 40 key on/run/key off cycles) before deleting the code entirely. This is not as uncommon as you might think, especially if the cause of the original failure is intermittent (like a wiring issue to a critical sensor that only fails when the harness is stressed in a certain way).

The only other way a MIL is going to turn itself off is if someone else cleared the data or battery power (to the Keep Alive Memory) was lost. I knew neither of those had happened, and connected my PC-based scan tool in full confidence I'd still find the offending DTC(s) stored.

I was a bit surprised by the DTC I found. It's not often you find a P0171 (System Too Lean, Bank 1) that has mysteriously fixed itself. Drilling down into the freeze frame data, I figured I should try and get a feel for the driving conditions that were present when the code set. I recalled the light turning on within a mile of my home on that chilly morning. Freeze Frame substantiated my memory of events by recording an ambient air temperature of 50°F and a coolant temperature that indicated an engine that was still a bit on the cold side at 167°F. The ECM was in fuel control as shown by the "Closed Loop" status, and the car was only running a bit off of idle at 997 rpm.

Read more on system lean codes and troubleshooting tips from Pete Meier online at MotorAge.com/leantrouble

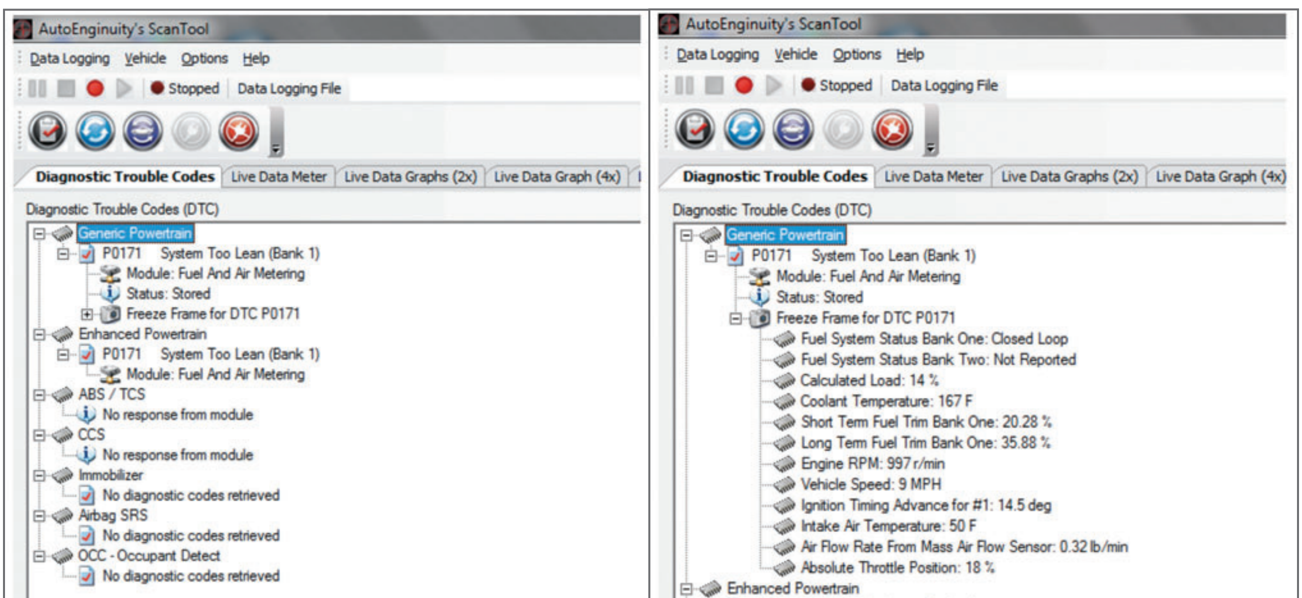
The Short Term Fuel Trim (STFT) and Long Term Fuel Trim (LTFT) definitely indicated a problem, logging 20 percent and 36 percent respectively. That's 56 percent total trim! And that's exactly what the computer is watching in this continuous monitor.

I can't help but think I'm dealing with a vacuum leak when I see System Lean codes set at low engine speeds. With the lower throttle opening, any air that enters the engine downstream of the Manifold Air Flow sensor (MAF) makes up for a larger overall percent of the total airflow going into the engine than it would at cruise speed and the resulting impact on fuel trim is that much greater. And there normally is an easy way to tell by simply comparing total fuel trim (STFT plus LTFT) at idle and at 2,500 rpm. If the idle trim shift is large and the cruise rpm shift is small or near normal, odds are high that there is unmetered air entering the engine somewhere.

Let's Find Out

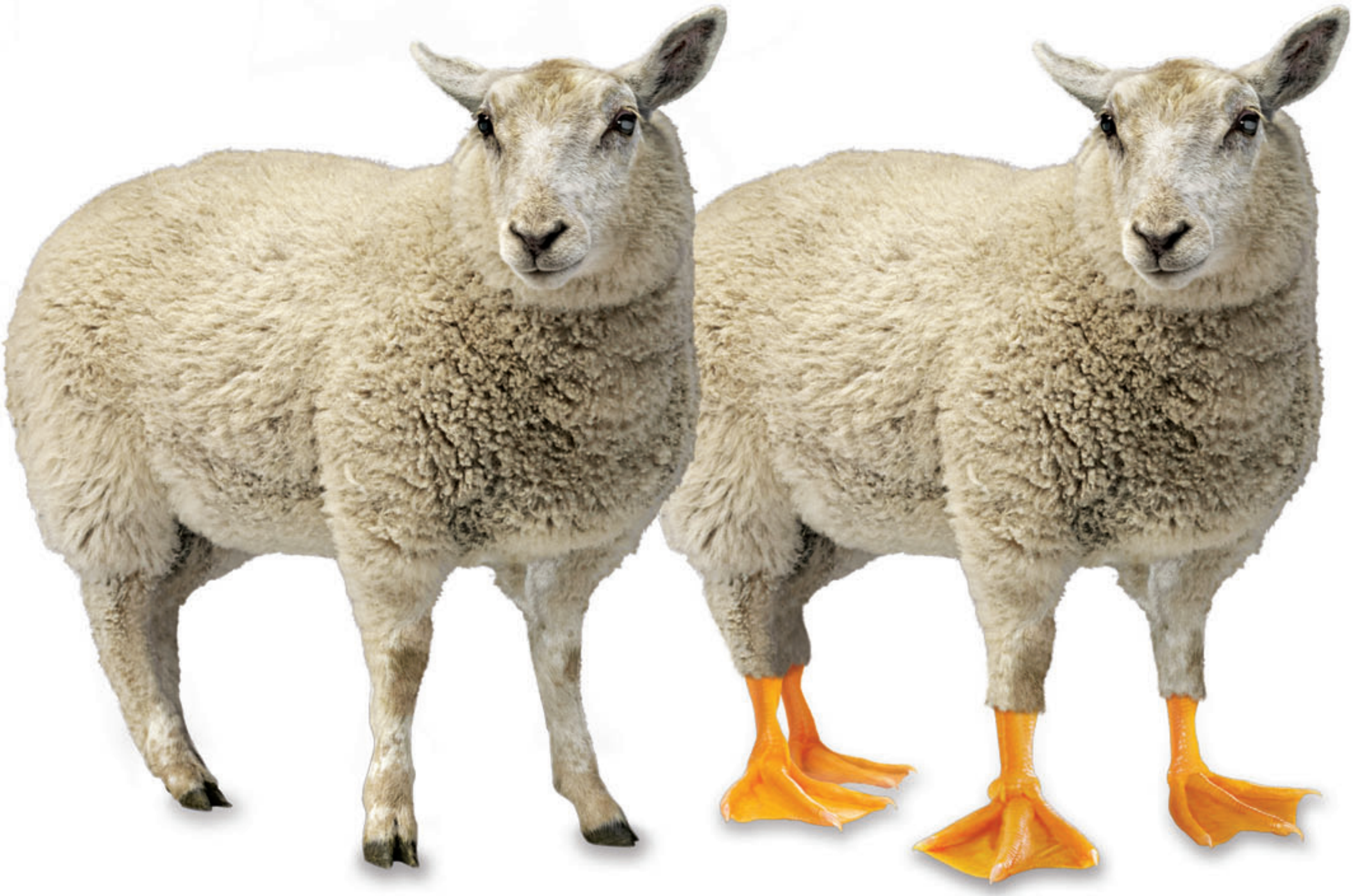
The outside air temperature on the day I was playing with the Toyota was closer to 85°F, so that would be one parameter in the Freeze Frame record I wouldn't be able to duplicate. But I could duplicate the cold engine temperature by watching the fuel trims as the engine warmed up.

I started the car after selecting just a few of the dozens of Parameter Identifiers (PIDs) for display. I decided for the moment to watch fuel trims (short and long), engine speed, engine temperature, Air Fuel Sensor (AFS) voltage, downstream oxygen sensor voltage, and the equivalence ratio for that upstream wideband-type sensor. This last is calculated lambda, or the expression of the air/fuel ratio itself with 1.0 being stoichiometric.

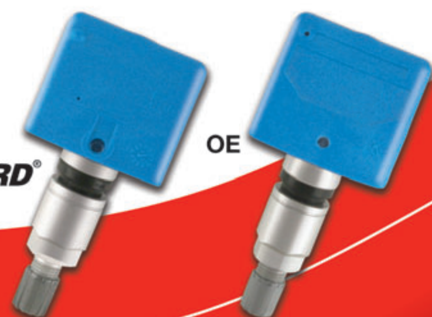


(Left) This PC-based scan tool (like many others) allows me to pull codes from all modules on the car. The P0171 code is logged in both Global and Enhanced modes. (Right) Digging deeper into the menu opens the Freeze Frame records, and provides some clues as to the cause of this fault.

If it's not a perfect clone, it's not quite right.



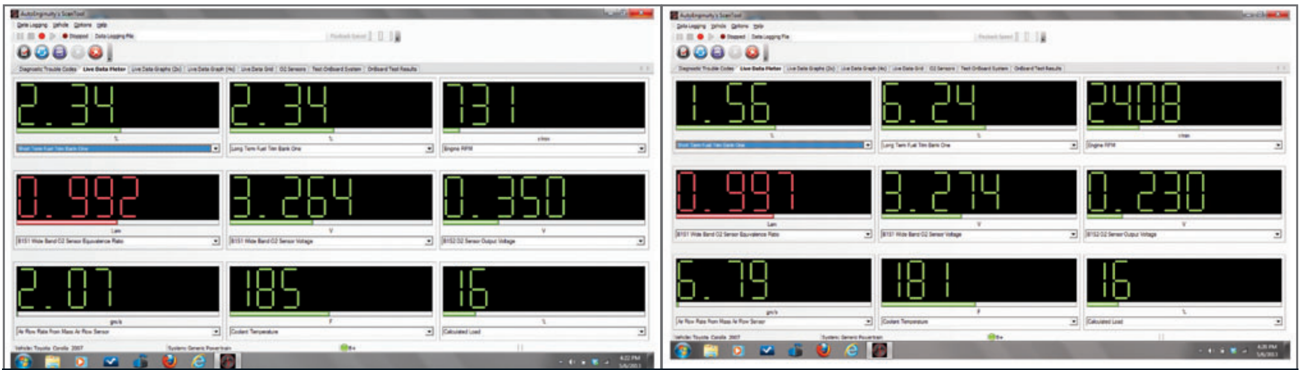
With over **98% coverage** and clone-able TPMS sensors that match or outperform OE, Standard® is the perfect TPMS solution for you and your customers.



STANDARD® Clone-able TPMS SENSORS

The right match…every time.

standardbrand.com



(Left) Top row showing STFT, LTFT and engine speed. Whatever was causing the lean condition isn't causing it now. (Right) It's habit for me to check fuel trim at idle and at 2500 rpm. The Toyota seems to be plenty healthy now.

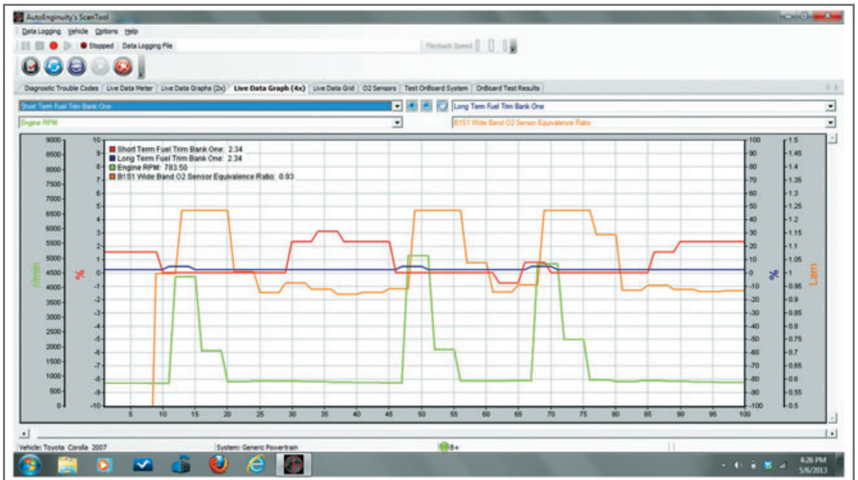
The car entered closed loop, and I saw nothing out of the ordinary. STFT was switching (slowly) and remaining under 5 percent, well below the ± range I usually go by on an engine equipped with a wideband sensor. LTFT was also reading just more than 2 percent and the 0.992 lambda number was off, but not excessively so. Whatever had caused the lean condition originally had disappeared.

Oh well, let's see what the trims do at a higher rpm. I raised the speed on the now warm engine to roughly 2,500. Here, too, fuel trims were reporting well within their normal range, though LTFT was a bit higher at just more than 6 percent.

The next thing I like to do is see if I can tell if the sensors responsible for letting the ECM know how it's fuel control strategy is working are telling the truth and reporting honestly. The Corolla has 75,000 miles on it, low for the car, but kind of high on the life span for oxygen sensors. I snapped the throttle a few times while graphing the sensor and fuel trim PIDs and still didn't see anything wrong.

Stick With Your Process

At this point, it looked like there was no repair to be made and nothing to



A few throttle snaps to wide open generally will tell you if the oxygen sensors are alive and kicking.

worry about. But I still was curious as to why it would run so lean that one time. As is my normal process, the next step was to hit the service information and research a bit on exactly what requirements need to be met for this code to set. I also make a habit of reviewing Technical Service Bulletins (TSBs) to see if there is anything there that might relate to the problem I was dealing with.

System Lean testing by the ECM is not that complicated, and Toyota shared the method most OEMs use. To quote the description I found, "Under closed-loop fuel control, fuel injection volume that deviates from those estimated by the ECM causes changes in the long-term fuel compensation value (LTFT). The long-term fuel trim is adjusted when there are persistent deviations in the short-term fuel trim values…if the average fuel trim value (total fuel trim) exceeds the malfunction threshold, the ECM interprets that as a fault and sets a DTC."

Simply put, if the feedback provided by the AFS tells the ECM that what it got was too lean, the ECM will respond by making STFT more positive. If that need persists, it will cause LTFT to adjust as a more permanent solution to the lean condition. And if the total amount of correction exceeds the threshold limits (in this case, 35 percent), the P0171 is placed in "pending" status. It is a two-trip code, meaning that the ECM has to see the same fault in the same rpm/load range in two consecutive tests before it will turn the MIL on, set the code as a "hard" code and log the data into freeze frame.

Hmmm. The Calculated Load PID on my idle/cruise tests was 16 percent, but the freeze frame recorded a 14 percent load. A clue? Could that ambient temperature difference explain the load difference? If the rpm/load was different, could that explain why the ECM turned off the MIL?

On to the TSBs. Interestingly enough, I did find a TSB (TSB2909 - discontinued) that spiked my interest. "Following a cold soak at sub-freezing ambient temperatures, some 2003-2008 model year Corolla … equipped with the 1ZZ-FE engine may exhibit a MIL 'on' with one or more of the following Diagnostic Trouble Codes (listing the P0171) as a result of a vacuum leak at the intake manifold." The fix was an upgraded intake manifold gasket. A check of the iATN (International Automotive Technicians Network) database revealed more than one hit reported mostly by members who lived way further north than I do.

Granted, 50°F is certainly nothing near "sub-freezing", but it did get me to thinking. I had run into similar issues with older Ford Windstar V6s that would leak internally only when cold, even by Florida standards. As much as my car sat, was that a possibility?

In the old days, we used propane or carb spray on a running engine to pinpoint an intake leak. That doesn't work very effectively on most of today's cars, for a variety of reasons. In my case, starting the car would quickly defeat the purpose of trying to find a leak that only occurred "cold." The best way to test? Smoke it!

EVAP Tester To The Rescue!

The same smoke machine you use to locate hard-to-find evaporative emissions system (EVAP) leaks is an excellent tool for so many more diagnostic purposes, including this one. I let the car sit overnight to give it time to cool off. I knew I might catch it if I waited to test first thing the next morning when the ambient temperature would be closer to 65°F. It wouldn't be quite the same outside temp but a darn sight closer than the current 85°-plus.

I hooked up the smoke line to the intake line attached at the EVAP purge solenoid and pumped away. Within a few minutes, I could see smoke exiting from the air box's fresh air inlet, but saw nothing apparent anywhere else.

Well, I guess that was to be expected. Even if my suspicions were true, it was way warmer out now than it was back in March.

Just as I was about to pack it in and call it quits, I noticed a small (I mean, very small) wisp appearing from the front of the engine, just above cylinder 2's intake tract. Granted, it wasn't pouring out but it was there, and I felt a small tingle of excitement. Sorry, I always get that way when a diagnostic theory proves correct! Admittedly, luck played a part and the alignment of the planets must have been in my favor, but the smoke was there and that was all I needed to see.

And believe me, I'll replace those gaskets first chance I get. (Or maybe I'll wait till next winter and smoke it again. Might make an interesting follow-up, don't you think?) 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.

Email Pete at pmeier@advanstar.com

CHECKING THE STOPPERS

The drum brake isn't dead — some 2012 Chevy pickups have drum brakes. These are kind of hidden and often get ignored until something obvious happens. In addition, leaking wheel cylinders tend to stain the tires with wet streaks, and shoes that are worn will herald their need for replacement with a jolly grinding noise.

YOUR CUSTOMERS HAVE TO BE ABLE TO TRUST THE LEFT PEDAL, SO THEY PUT A LOT OF TRUST IN YOU.

BY **RICHARD MCCUISTIAN** | CONTRIBUTING EDITOR

A friend of mine was driving his high mileage Toyota Camry a few years back and experienced normal stops right up to the point where one brake pad finally wore thin enough that it left its perch in the caliper and shot out of there without warning. His pedal went to the floor and he had to swerve off of the yield lane over onto the grass to avoid driving under the side of a passing semi-truck.

It happened because the Camry's rotors had been repeatedly machined, but not measured too many times (I did not do this work, by the way). The moral of that story is to always measure the thickness of the rotors and the diameter of the drums when doing the brakes, even if they look good. And it's a no-brainer that we should replace the rotors rather than machining them if they're too thin.

Every driver desperately needs to be able to trust that left pedal. The old adage that "a miss is as good as a mile" might make some brake failure stories humorous, but brake failure is no laughing matter, and there are many other stories involving failed brakes that are life-changing in a very bad way.

Iron, Steel and Linings

Drum brakes are still very common and require more inspection effort than discs, particularly when the shoes have dished the inside of the drum and/or the drum is rusted solidly to the hub. Most foreign nameplates have 8-mm threaded holes near the center of the drum where bolts can be screwed in against the hub flange for drum removal. A smart tech working an unfamiliar platform will leave the drum brakes on one side assembled for comparison while doing the opposite one. When machining drums, measure them first for service limit and don't let the drum pass the bit too fast or you can thread the drum while machining it and cause noise concerns.

JUST SCAN IT

Scan this QR Code to watch on your smartphone a video about servicing VW electronic parking brakes. Or visit MotorAge.com/vwbrakes

GET A FREE SCAN TOOL APP AT: www.scanlife.com

Those drum-style parking brakes that are in the rotor hat on newer Chevy pick-ups usually are worn out and are easy to replace while doing the rear disc pads. On the ball-and-ramp park brakes used on some rear disc systems, you need the tools to screw that rear caliper piston back in rather than simply shoving it, so don't get blind-sided on that deal. If the park brake cables

Photos: Richard McCuistian

ReadyMount® Strut Assemblies

WE'VE EXPANDED OUR LINE BY MORE THAN 25%

We rival the competition for coverage, but they can't match us for quality.

We've added over 40 new, **first-to-market** designs to our rapidly expanding premium ReadyMount® line, which means the first name in ride control should always be your first choice for pre-assembled struts. Just like every new shock and strut we make, every new ReadyMount pre-assembled strut design is Precision-engineered to the OE design, Component- and Unit-tested, and Fit- and Ride-tested to ensure unbeatable quality. Plus, each new strut design has been validated to 1,000,000 cycles and features our advanced G-Force™ Technology. So, check out Gabriel.com today, explore our expanded line of nearly 200 ReadyMount strut designs and learn why they're the perfect fit for you and your customers.

- Precision Engineered
- Fit-Tested
- Ride-Tested

Learn more!
Scan to see how you get more with Gabriel ReadyMount!

The Original Gabriel®
Ride the independent spirit™

are rusty and cause the brakes not to release, those cables might need to be replaced. This happens sometimes on older pick-ups.

If we're doing any service at all on a vehicle and we've got it on the lift, we're remiss if we don't at least bust out a flashlight and have a look at the disc brakes, both front and rear. Disc brakes usually feel just fine, but we've all heard them make noise when the lining gets thin enough that the sensor reed begins to sing against the rotor. A few platforms have pads with an imbedded wire that illuminates a dash panel warning light when the lining is worn to replacement thickness.

And be sure to check both pads on each rotor; a caliper that won't float sometimes will wear the pad completely out on the piston side while leaving the outboard pad looking really good. When pad lining exhibits wedge-shaped wear, that means one end of the caliper is hung and won't float. Replacing the bolts and boots on calipers that have that hardware is a must if those parts are compromised. And make sure the caliper abutments are clean, rust-free and lubed on the older ones that ride in slides.

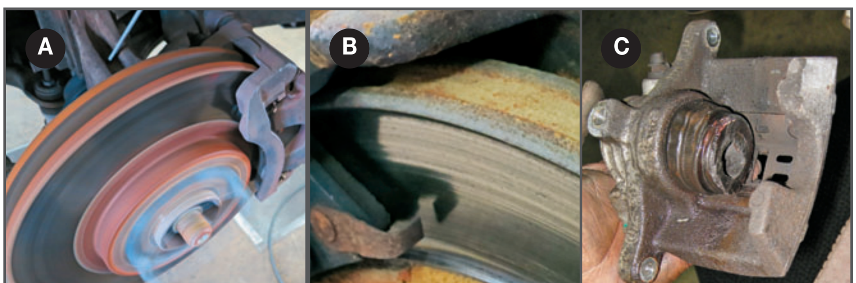
When machining disc rotors that are thick enough, on-car is the smoothest way, but doing it right on a bench lathe works, too. According to Ammco® your cutting bits run cooler when you're making a 0.010-inch cut than when you're making a 0.002-inch grind, as counter-intuitive as that might sound. Make sure there are no rust or bumps in the hub area when mounting the rotor. I like to brace a wrench and hold it gently against the spinning hub to be sure the hub is running true before beginning the cut.

When you're done with the machining, use a drill and a refinishing pad to non-directionalize the finished surface on both sides of the rotor. Bendix® says to wash the surfaces of the rotor with soap and water before installation to remove all the embedded filings. With new linings installed, drive the car and burnish the new pads to the rotors using the Bendix 30-30-30 method, which is defined by 30 normal stops from 30 mph with a 30-second cool down in between.

Read more about state laws restricting and eliminating the use of copper in brake friction material at MotorAge.com/statelaws

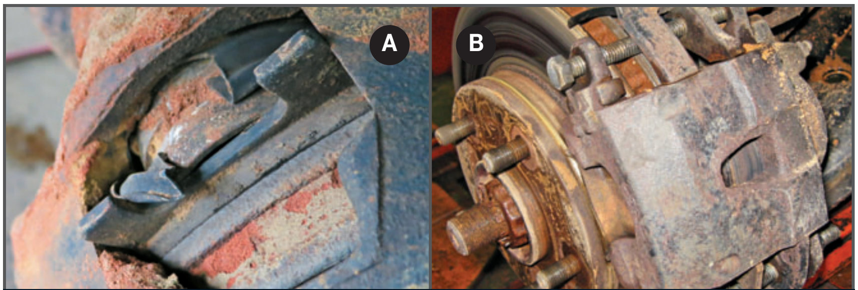
The Fluid

A few simple pointers where fluid are concerned. Fluid level is a no-brainer, but checking brake fluid level should be supplemented using the Phoenix Systems® dip strips to check for copper alpha reactions in the fluid. This dip strip test is a dynamite way to sell a necessary flush. The strips cost $70 for 100, and you dip the strip in the master cylinder reservoir, shake off excess fluid (not on the fender) and then watch it for a minute to see how purple it becomes. There is a color code card you



These, along with the tires they're connected to, are responsible for bringing a 3,000-plus pound vehicle from road speed to a stop over and over for thousands of miles. The middle photo is a rotor with its cooling fins packed full of mud. The photo at right is what happens when the pads grind the rotors thin enough that the piston comes out of its bore. Scary stuff.


MAHLE
Driven by performance
HERE
A WHOLE LOT
GETS STUCK.
We don’t need to tell you how important perfectly functioning filter systems are for optimum performance. In case you didn‘t know, MAHLE Original is the world leader in high-quality oil, fuel and air filter production. All the same - your shop needs to stock our products - contact MAHLE Clevite Inc. to start stocking today!
www.mahle-aftermarket.com
Know Your Parts
AASA
Be Car Care Aware
MAHLE ORIGINAL



It is always amazing how much punishment and neglect brakes can put up with and still stop the vehicle in a fairly normal fashion. It's also amazing how some folks are at doing those grass-and-dirt patch jobs (see right).

use to determine how purple is too purple. The coolest thing about this is that it's a good show-and-tell when dealing with a skeptical customer. That being said, flushing is good if you do it right and bad if you do it wrong.

Decades ago, Delco marketed a purple colored alcohol based flushing product called DeClean – it's so old now that you can't even find it online (or at least I couldn't). But I bought cans of it from my Delco parts supplier in the 1970s and used it for flushing brakes and even on HVAC systems when the compressor had failed. I don't know when they stopped making it, but I might have been using old stock from that ancient parts store. I'd pump a bunch of it through the system and then push the stuff out with new brake fluid.

I used some denatured alcohol to do a high-mileage 2000 Chevy pickup that way and had the HCU fail. After he drove it for a day or two, the HCU started trapping pressure on the business side of the system, the brakes wouldn't fully release. The rest of the rubber parts were pristine, but the alcohol had broken stuff loose and moved it around in there, which fouled up the Hydraulic Control Unit. The best way (my opinion) is to use clean fluid, and we have done that on many a vehicle with no ill effects.

Pistons, Cylinders and Air

If a brake caliper is stuck, it can be rebuilt (which isn't hard to do right), though it's a lot quicker to simply replace it. But don't condemn a brake caliper without first making sure it's the caliper that's at fault.

If one comes in with a locked and smoking wheel and you open the bleeder screw to find that the caliper lets go of the rotor, you have problems between the caliper and the reservoir. If somebody has let the caliper hang on its rubber hose a few times (don't do that), the hose can come apart internally. But that usually causes a brake pull in the opposite direction from the bad hose. Pressure trapped at the caliper typically is master cylinder or combination valve related. ABS system parts can cause that problem, too. I once saw a 2002 Chrysler Sebring with rear rotors that were downright rusty. The rear brakes were getting no fluid pressure at all, and that turned out to be a bad proportioning valve.

Drum brake wheel cylinders are easy to check – just pull the boot back on the wheel cylinder and if you see fluid there, the cylinder needs to be rebuilt or replaced. In the 1970s, we always rebuilt the wheel cylinders as a part of a routine brake job, but these days almost nobody does that. When replacing wheel cylinders, be prepared to replace or properly repair the line on old rusty, mud-slinging or salty road vehicles.

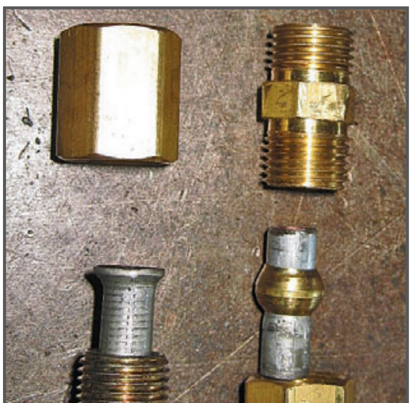
When bleeding the brakes, make sure you delve into the shop manual instructions to make sure you're doing it right, lest you work long and hard and come to ruin. My guys worked diligently on a 2008 Nissan Frontier a recently before I directed them to follow the wheel bleed sequence in the shop manual. They had started with the farthest wheel from the master cylinder and worked their way around to the nearest one but the pedal still felt spongy.

On that truck, you absolutely won't have good pedal unless you follow the

The fluid is every bit as important as any other part of the job. It tends to transfer to the calipers as the pads get thinner, and so the level needs checking regularly, as does the condition. These dip strips are a dynamite way to determine whether or not a flush is needed.

published sequence. You can't go RR, LR, RF, LF on that one. If you do it in the right order, you'll get the air out quickly. If you bleed the wheels in the wrong order, you'll work on it for hours. Some vehicles require a scan tool and the operation of the HCU pump. Others have release buttons that have to be held during the bleed procedure.

Tools for brake bleeding abound, and some are better than others, but I teach my students to use a clear hose attached to the bleeder screw and a clear plastic bottle. Learning the old-fashioned way first is best, as not every shop has a brake bleeder. It's also good to start the engine and feel the pedal even after it feels OK without vacuum applied to the booster, or else you might think you're done when you're not. Be aware that a leaking master cylinder can dump its fluid into the booster, so watch for that.



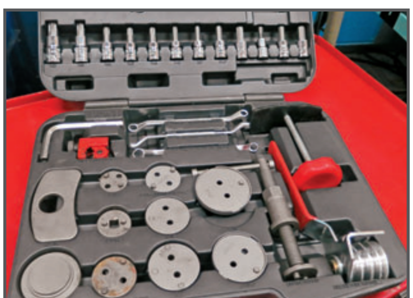
I've said this before, but don't ever use a copper tubing union (right) to repair a brake line. The only right way is with a double flare and a union like the one on the left.

On a Wing and a Prayer

What about those vehicles we service that belong to drivers who are either so adaptable or so obtuse to either continually ignore or don't notice that their brakes either don't sound or don't feel right? These drivers are some of the same folks who don't think they need to change the oil as long as the car still seems to be running OK.

Then there are the brakes that have been patched or modified by a do-it-yourselfer. You know, the ones with missing hardware that are held together with the wrong bolts or bent coat hangers? The ability of a car's brake system to work as well as it does even when sloppily patched is pretty amazing.

We had an SUV of that stripe come into the shop one day a couple years ago. The owner had called earlier to say she wanted her front brakes done and asked how much it would cost. I called my parts guy and he didn't ask me anything about how the vehicle was equipped, he just gave me prices and I passed the information along. After all, what was she likely to need besides pads and rotors? The customer had her daughter bring in the SUV.



These fairly comprehensive and affordable disc brake kits are sold at most parts stores and cover a multitude of different disc brake types.

When we got the wheels off, we saw all manner of missing hardware, incorrect assembly, etc. We set about to do the brake job with the parts my supplier sent and found that this one needed more expensive rotors because it had ABS. That doubled the price of the job, and in the melee of having her shout at me on the phone, I forgot to mention that we also needed a hardware kit, which was an additional $25, which led to more shouting later.

Now for an extremely important question: What if she had said no to the repairs in the beginning and told us to put it back together the way it was? The simple answer is that if we were a regular shop, we couldn't comply – not without serious liability. We fixed her brakes and did it right. But if we had been red-lighted on the repair, we would have been wise to render the vehicle undriveable so she would be forced to have it towed away rather than letting her drive it away with brakes we reassembled the wrong way we found them.

If a vehicle leaves your shop on the hook and somebody else patches the brakes to get it back on the road, you're pretty much in the clear. But even if the customer signs a waiver when the vehicle is picked up and drives it away under its own power, you can still get sued and lose if the patched brakes are the cause of a crash. And if the crash causes a serious injury or takes a life, well, it's unpleasant to finish the thought.

Brakes are some of the most regular and most profitable repairs we get and they're probably the easiest jobs to do right. MA

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.

E-mail Richard at rwm19@mail.com

DESIGNED TO MAKE IT EASY

NUMBERED LEADS

At Intermotor® our goal is to achieve excellence by pushing for the "plus" – the extra details that set our products above the rest. Intermotor® Import Ignition Wire Sets feature original equipment fit, form and function plus all the extras you'd expect from an industry leader, including factory-installed clips, trays, loom and numbered leads*. With unmatched coverage for ALL import nameplates, we are the import leader by design.

Intermotor®
Genuine Import Parts

THE IMPORT LEADER BY **DESIGN**

SMP®
Standard Motor Products, Inc

WORDS FROM AN INSTRUCTOR

FOLLOWING AN ANNUAL TRAINING EVENT, ONE MOBILE DIAGNOSTICIAN BRINGS MISFIRE DIAGNOSTICS FROM THE CLASSROOM INTO YOUR SHOP.

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

TST hosted its 10th Annual Big Event this past March in Fishkill, N.Y. Presenting at the event were John Thornton and David DeCourcey. DeCourcey owns D&D Professional Automotive Services, a mobile diagnostic service and training provider in Worcester, Mass., and is appearing here as a guest columnist. To see more from DeCourcey, visit his website at DDProfessional.com.

Mastering Misfire Diagnostics

My course, "Misfire Strategies for Today's Vehicles," was meant to teach attendees to concentrate on three topics during the troubleshooting process. The main focus of any misfire diagnosis must be on the combustion process. Anything that negatively affects the combustion process will create a misfire. These negative effects are simply the three Ls: Lack of a combustion process; Low combustion process; and, Late (or early) combustion process.

Second (and most important) is locating the actual root cause of the misfire. In most cases, the effects of the misfire are detected easily. Locating the root cause for the rough idle, sputtering on acceleration or any other outward indication of the miss can be more elusive, especially with intermittent faults such as leaking fuel injectors or a weak, leaking or overheating ignition coil.

Third is the importance of using a solid diagnostic process for locating the root cause of the misfire. The idea is multifold as to keep focused, to avoid random testing, to prevent replacement of good parts and to reduce the total time spent on the diagnosis.

Follow me as we take a look at a 2004 Kia Sedona minivan with a 3.0-liter V6. The little van has approximately 78,000 miles on the odometer and a local dealer recently installed a used engine. The shop reported the customer was complaining of a rough-running engine and a lack of power when accelerating. The Malfunction Indicator Lamp (MIL) was on and, on occasion, flashing. These all are sure signs of a misfiring cylinder.

The shop's tech had verified the customer's complaint and performed a visual inspection. He had retrieved a series of Diagnostic Trouble Codes (DTCs) indicating misfires in cylinders 1 and 2 (P0301, P0302) as well as a random misfire code (P0300).

While attempting to fix the problem, he replaced two of three ignition coils on this Distributorless Ignition System (DIS) and tore down the front of the engine to inspect the cam-to-crank timing. That, of course, proved to be correct.

Do you see any mistakes he made? For one, he's testing randomly. How do you jump from swapping coils to pulling the engine apart? This is because he's not following a solid diagnostic process. He's not focusing on the three Ls. And he's replacing parts unnecessarily.

How do you go from swapping coils to checking cam timing? By not following a logical process, that's how.

Let's Start Over

When I'm called in by another shop to troubleshoot a problem, I always come in "cold." I really don't care what you've done so far. I start from the beginning as if the car had just been brought to me in the first place.

And where does that start? I've developed my own Misfire Diagnostic Work Sheets. They provide a simple step-by-step diagnostic process for determining the root cause of any misfire condition. There are a total of six worksheets, but since I've been using this diagnostic process I've found that in most cases I'll rarely complete the

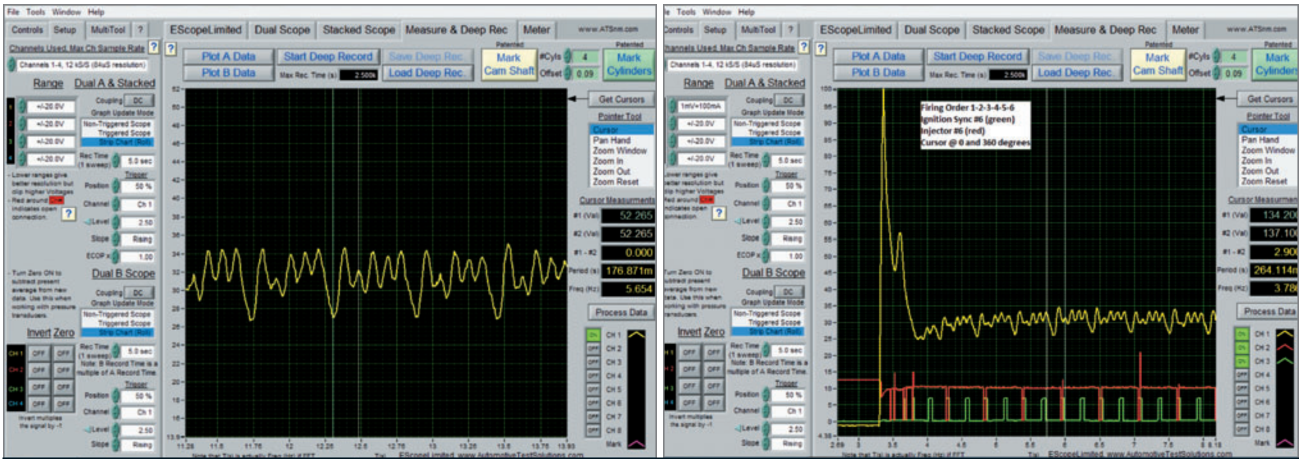
JUST SCAN IT

Scan this QR Code to read on your smartphone more about TST's Big Event. Or visit MotorAge.com/bigevent

GET A FREE SCAN TOOL APP AT: www.scanlife.com

Photos: David DeCourcey


Designed
with the
Professional
in mind
3-color LED display for state emissions readiness check
On-screen definitions in English/Spanish/French
Large all-in-one display shows over 20 pieces of diagnostic information
Displays the Diagnostic Trouble Code (DTC) number
DTC definitions, freeze frame and live data
Serious professionals trust INNOVA® expert diagnostic tools to help them make fast, accurate and profitable repair decisions.
ASE-certified technicians help design INNOVA® tools with the needs of pros in mind
INNOVA® scan tools allow fast retrieval of vital diagnostic information, helping technicians efficiently complete more repairs
All tools come with shop management software reports to manage vehicle diagnostics
RepairSolutions® with extended diagnostic support available
Designed for heavy shop use
ASE bilingual technical support for professionals available Mon - Sat, 6am - 6pm PST. USA based
To learn how INNOVA® can save you time (and make you money).
www.pro.innova.com
INNOVA®
EXPERT DIAGNOSTICS



(Left) The cranking amperage test quickly revealed a mechanical problem with two cylinders. (Right) A reference trace is any waveform that helps you identify where you are at in another. Here I'm using cylinder 6 ignition and injector events to identify the weak cylinders by firing order.

third worksheet before the root cause is revealed.

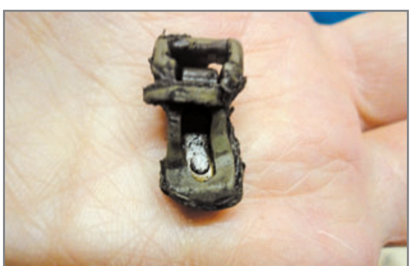
Let's start in on this soccer mom's car using page one of the worksheet.

1. Verify the customer's complaint. That can be as simple as checking for codes or taking a test drive. All I had to do on this one was start it and let it idle to know that it had a dead hole.

2. Perform a visual inspection. Note all recent work, bodywork and aftermarket accessories, but do not disturb anything. If I see a possible issue, I will verify it as being the actual problem during the diagnostic process. Nothing stood out on the Kia so I moved to the next step.

3. Check the charging system. Check for large voltage drops and excessive EMI (electric noise). I prefer 150mv AC or less, and my personal maximum allowable spec is 300mv AC. It's amazing how many cars I've fixed by simply correcting a bad cable ground. That wasn't the case on the Sedona.

4. Check for binding/seizing accessory drive components. A jerking motion of the belt tensioner will be a giveaway of a binding accessory drive and can be enough to set a misfire code.



This piece of zip tie wedged itself into the intake valve, holding it open.

5. Perform a Relative Compression test. This is a quick way to see if the cylinders are contributing their share. That's where I found my cause.

I only connect a high amp clamp when I perform my cranking amperage test. I just want to quickly gauge the engine's health. In the case of the Kia, the current draw pattern clearly showed one cylinder was totally dead and another was low. Now the extra effort is justified to hook up another channel on the scope and get a reference I can use to identify exactly what cylinder is causing me problems.

You might think it's going to be cylinders 1 and 2 based on the codes the first tech pulled from the ECM. But I've found more than one case where the codes lied about the cylinder that was truly weak. I rarely rely on that alone. Let's see if that plays out on the van.

The ignition firing event occurs closest to Top Dead Center (TDC) on the compression stroke and makes a great reference. Synch off any accessible ignition coil, then use the firing order to determine the non-contributing cylinder. I synched off the cylinder 6 ignition coil and the firing order is 1-2-3-4-5-6. Keep in mind that this is a waste spark ignition system; each ignition coil fires twice every 720° of crankshaft rotation. How can I be sure I am actually syncing off the ignition event for cylinder 6? Or am I looking at the waste spark?

How would you further identify the cylinders? What about the injectors? They inject fuel near TDC, but on the exhaust stroke 360° before the combustion event. Adding the injector reference now allows me to identify the non-contributing cylinders by firing order. I now know for certain that cylinder 1 is contributing very little and cylinder 3 is weak.

There is no number of spark plugs, coils, injectors, etc. that can be installed in an engine to repair a low or non-contributing cylinder. With the weak cylinder identified, it was easy to dig a bit deeper and find the actual cause of the compression loss. A piece of wiring harness zip tie had been accidentally dropped into the intake manifold during assembly and had become lodged in the cylinder 1 intake valve. Had the first tech focused on the combustion process, and followed a solid diagnostic process, this shop could have saved the cost of my diagnostic fees, unnecessary parts replacement and wasted time.

So remember those three Ls when you get your next misfire complaint. MA

G. JERRY TRUGLIA
CONTRIBUTING EDITOR

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

Email G. at gtruglia@tstseminars.org

NOT ALL BUGS ARE THE SAME

DOES IT EVER SEEM LIKE ALL THE CARS COMING INTO YOUR SHOP HAVE BEEN BITTEN BY THE SAME BUG REQUIRING THE SAME FIX?

BY **TIM JANELLO** | CONTRIBUTING EDITOR

You know how it goes. One car comes in with a problem, and then several follow. We had a 2006 Nissan 350Z come in the lab with a simple, so we thought, cylinder 5 misfire Diagnostic Trouble Code (P0305 DTC). The car showed all the normal symptoms of a bad spark plug. The 3.5L V6 ran rough, idled bad and smelled worse. But it became a head scratcher before we found the real root cause.

NISSAN NO. 1

2006 NISSAN 350Z
Vehicle Year/Make/Model

3.5L
Engine

AUTOMATIC
Transmission

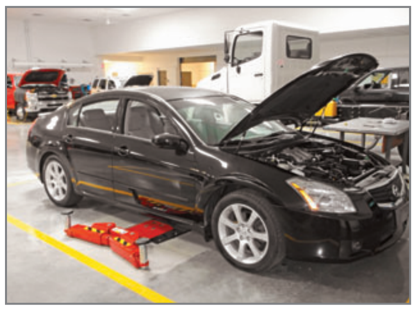
69,056
Mileage

MIL ON, ENGINE SHUDDERING, POOR MPG, DTC P0305
Vehicle complaint

Just after we won this battle, a 2007 Nissan Maxima with 3.5L V6 (at right) came in with basically the same codes and symptoms. The students said, "We got this," but it turned out to be a completely different problem. Two Nissans, same DTCs, same engines, but the root causes turned out to be totally opposite of each other.

The 350Z had been running rough and repeatedly turned on the Malfunction Indicator Lamp (MIL) for the same DTC. The normal parts had been thrown at it. New spark plugs were installed and the No. 5 cylinder spark plug was changed three times. Then a new coil was installed on No. 5 cylinder after the coils from other cylinders had been switched around with it, but no change was noticed.

When I walked up to the car, the idle was noticeably rough and a rich running engine smell (that noticeable "rotten egg" odor) really caught my attention. These are all signs of a run-of-the-mill misfire, right? The only thing that seemed abnormal was the MIL not blinking. A blinking MIL usually means excessive emissions and possible catalytic converter damage, but the owner only complained of poor gas mileage and drivability.



The Maxima came in a few weeks later with the same symptoms, except it had a cylinder 4 misfire (P0304)

Photos: Tim Janello

DTC and the occasional random misfire (P0300) DTC. It ran rough, idled poor and smelled rich also. The students checked for a misfire by doing a cylinder balance test, but reported they found nothing conclusive. They pulled the plugs, found them worn and very dark in color, and replaced them with new ones. No change was found when the engine was started. They then decided it must be the same problem as the 350Z. Does that type of statement sound familiar? I suggested they run some tests before replacing any more parts.

> "Now there are several ways to use a scope to test a MAF. You can use an amp clamp on the battery wire supplying power to the sensor. This method allows you to see the amp draw increase as you accelerate."

350Z's Diagnostic Process

The conventional thinking process always centers on the DTC. The first thing to remember is an Engine Control Module's (ECM) logic only points to problems it cannot correct. If an ECM could figure out all problems then life would be simple, but they can't. I like to do the simple tests first then proceed to the harder tests until the problem is found and the root cause is corrected.

We had a scope handy, so we performed a cranking compression test using an amp clamp around the negative battery cable. The idea here is that as each cylinder on the compression stroke approaches top dead center the amperage draw increases to a peak. All the peaks were equal, meaning the compression for each cylinder was about the same. So we started testing for vacuum leaks. Using both propane and sonic ears, we painfully tested for leaks, but found none. Next, we moved the amp clamp to the wire feeding power to the cylinder 5 coil. This way we can see if the circuit is flowing proper current and look for connection issues.

Read more stories from techs across the United States and share your true stories at MotorAge.com/magarage

The oscilloscope image showed a consistent amp ramp that was the same as the others. We tested the spark output voltage of that coil and two others, with all three reading about 8 kilovolts (Kv). Finding nothing, we looked at the service information and technical service bulletins for any hints. The usual procedures ranging from spark plugs to vacuum leaks were suggested with no one statement caching my eye.

The next to last possible problem in the service information listed the bank 1 Air Fuel Sensor (AFS) as a possible cause. I was unsure how that could cause a miss, but wondered why they only listed bank one and not both, especially since they listed all misfire codes from random (P0300) to each specific cylinder (P0301-6) under the same procedures. We dismissed this idea for now and continued with the normal issues related to misfires.

Now it was time to look over all the tests we had performed and the scan tool data. I went back to the Freeze Frame data looking for when the DTCs were setting and under what conditions. I noticed that about five minutes after starting the engine cold and before the engine was up to normal operating temperature, the code or codes would set. The next step was to test the fuel injectors to see if one was sticking or leaking causing a rich condition that only happened on engine warm-up.

I noticed bank 2's old spark plugs were almost black in color while bank 1's plugs were of normal color. I went back to the scan tool looking at the AF sensors to see if bank 2 was richer than bank 1. That is when we noticed the lack of response from the bank 2 sensor. We forced the system rich and then lean looking for a response. Its readings

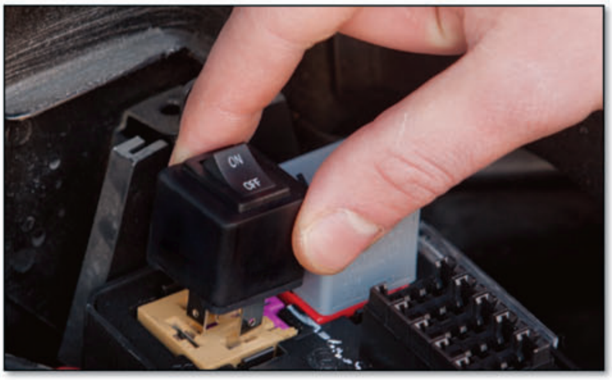
Using an amp meter and jumper leads, we checked amperage draw of AF sensor 1's heater circuit at the sensors harness connector.

This amp meter reading shows the bad AF sensor heater's reading. Notice the .3 amp as compared to a normal of a little over an amp after the engine had been running for a while.

We originally tested the total amperage draw for both heater circuits on the 350Z at the fuse panel behind the left kick panel. Our total amp draw for both AF's heaters read only about 1.4 amps. With the new sensor in place our meter is showing 2.2 amps a few minutes after the engine was started.

6-PC. RELAY BYPASS SWITCH MASTER KIT #9038

Energize a Fuel Pump with the Push of a Switch



QR Code for Link

- Actuates fuel pump when the engine is not running
- Plugs in place of relay
- Controls fuel pump independent of 'key on' systems
- Operating range: 20A (12V)
- Covers most domestic, Japanese, Korean, and German applications

FUSE SAVER® MASTER KIT #8016

Chase Down Short Circuits Without Replacing Fuses

DISC BRAKE SYSTEM ANALYZER #7884

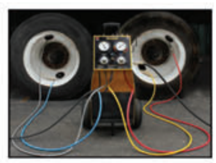
Uneven Brake Pad Wear?

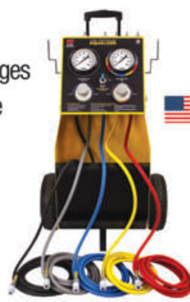
Eliminate Guesswork When Troubleshooting Disc Brake Problems

MOBILE TIRE PRESSURE EQUALIZER #9060

Five Tire, High-Flow, Dual Regulator, Tire Inflation System

- Highly accurate, glycerin filled, presssure gauges
- Inflate/deflate/equalize up to five tires at once





ENGINE CALIBRATION SET UP KIT #7891

Eliminate Mistakes When Performing Engine Setup Procedures

MANTUS™ TIGHT ACCESS TOOL #8041

A Grip Tool; Also doubles as Terminal Cleaners for Male Spade Pins

TIRE COMPARATOR™ (TYPE II) #9067

A Quick and Easy Way to Ensure Dual Mated Tires are within Tolerance

- Extend tread life, reduce blow outs and tire decapitation
- Can be used on any dual mated tires

(Left) At a 70°F engine start up, both AF sensors on the 350Z pulled almost 3 amps, but by the time I took this picture the amperage flow had dropped down to 2.64. (Right) Would this reading have caught your eye? The Maxima's MAF varied from 4 to 7.1 g/s. The engine was idling as low as 500 rpms while reading 4 g/s. But the MAF reading went to 7.1 g/s at only 750 rpms. With the car in park we noticed the MAF reading increased faster than the RPMs increased as we revved the engine.

changed, but not as much as bank 1. The service information at step 14 and 15 of the OEM flowchart has you disconnect the AF sensor 1 and ECM connectors to check for continuity and then check for grounded circuits.

At step 16, it mentions testing the AF's heater but not how. The students wanted to replace the AF sensor and I was about to agree when I decided to tell them to test the heater circuit first. They asked why the AF heater monitor passed if there was something wrong. I responded with, "The AF monitored passed, but you think it's bad."

They decided to test the heater circuit. We looked at the wiring diagram and decided to test total amp draw at the fuse. They jumped the heater fuse with a test lead and used their meter to test total amp draw. It seemed a little low, so I had them use their jumper kits to test each AF sensor. Both AF to harness connectors were located over each valve cover making it somewhat easy to do.

Bank 1's amperage was about 1 amp, while bank 2 was down around 0.3 amp. I prefer amperage rather than an ohm meter. Testing a circuit while it is flowing amps usually yields better results when looking for connection issues, plus the heater element changes resistance with temperature and may reveal an open circuit when hot.

The duty cycle of the heater showed the same on the scan tool, so we checked for voltage drop at each AF sensor connector. They both read the same voltage, so we decided the AF sensor was, indeed, bad. We ordered a new one and installed it the next day.

We ran several total amperage draw test with each test reading around 2.1 amps. This solved the problem, but remember the service info only mentioned bank 1 as a possible cause, not bank 2. Don't follow service information steps blindly, always think and question why you're performing the tests outlined in the flowchart. The AF sensors would warm up enough to pass the monitors, but triggered the engine to run rich enough to run and idle rough under certain conditions. When driven, the heat from the engine would heat up the sensor enough to allow it to work normally.

On To The Maxima

A few weeks after the 350Z left the lab, another Nissan appeared with the same symptoms. It had a cyllnder 4 misfire (P0304 DTC) instead of the P0305 the 350Z suffered from, and added a random misfire DTC (P0300). The 2007 Maxima is equipped with the 3.5L V6 that has basically the same engine and ECM programming as the 350Z. Naturally everyone, including me, is thinking we know what the problem is.

The students grabbed the scan tool and hooked it up to verify the DTC. The P0300 random misfire code was an added issue, and I still like to stress to students the need to test before they replace any parts. We looked at the AF sensor data first and were surprised to find both values similar in both generic and enhanced modes. The voltage values were interpreted differently, 14.4V in enhanced mode and .38V in generic, but were equal and varying although they were mostly staying on the rich side. This changes the game so now we are back to starting at the beginning.

The diagnostic flowchart is the same as the 350Z's which groups the random code with the cylinder specific codes. The way the engine was running and the heavy rich smell made me think more on the fuel management side, but could it still be an AF sensor heater? What if they were not heating up the AF sensors properly? This would make the ECM add fuel.

We took the car for a short test drive to fully warm up the engine and the exhaust system. The engine ran better while driving it but we had a little hesitation on acceleration and some chugging as we backed off the throttle. As soon as we let the car idle, the roughness returned along with the rotten egg smell. If the car idled for around five to 10 minutes, the engine would start missing and you could see a little black smoke. The P0300 or a cylinder specific code would return if we let it run long enough or upon

What are the odds? Just goes to show it pays to do a visual inspection.

restart. We actually had a P0305 DTC set once, which is spooky.

We checked the normal fuel-related issues like fuel pressure, cylinder balance and ran a compression test. The spark plugs looked fine, except they all were blackish in color. We hooked up a scope with an amp clamp to the injectors to look at injector ON times and for a circuit issue that might cause the injectors to spray too much, but everything looked normal. The fuel trims were a -25 percent short term and -10 percent long term, showing the engine was running rich and knew it.

We looked over the service information and at step 16 it displayed a chart with what Nissan considers as normal Mass Air Flow (MAF) sensor readings.

The problem with their suggested readings is the range is too large. They suggest a range of 2.0 to 6.0 grams per second (gm/s) at idle and 7.0 to 20.0 grams per second at 2,500 rpm as a basis for diagnosing a contaminated MAF. That is a big range when you are looking for an issue like this. The old rule I have used is 1 gm/s for each engine liter of displacement at 600 rpms of no-load idle. While it's not foolproof, it is far more accurate. The engine had a rough, fluctuating idling from 500 to 700 rpm. Doing some quick math I divided 700 by 600 then times 3.5 gm/s equals about 4.1, but the readings were always a little high.

Now there are several ways to use a scope to test a MAF. You can use an amp clamp on the battery wire supplying power to the sensor. This method allows you to see the amp draw increase as you accelerate. If the MAF outputs a voltage this test works the same but you need a good scope program that can convert frequency. I also hook a channel of the scope to the Throttle Position Sensor (TPS) for a response comparison. As you blip the throttle, the volts or amps increase similarly to the TPS voltage.

We just decided to do a visual first so we removed the two screws holding it and lifted it out of the tube. This time the visual inspection really paid off! A bug was touching the element in the MAF causing it to read off. Once we blew off the bug and reinstalled the MAF the car ran great. MA

TIM JANELLO
CONTRIBUTING EDITOR

Tim Janello is an assistant professor for Southern Illinois University in Automotive Technology teaching baccalaureate students for the past seven years. He has 40 years of experience in the automotive repair field with Master ASE certification and L1.

Email Tim at tjanello@siu.edu

the latest products

& TECHNOLOGIES TO HELP YOU WORK SMARTER AND KEEP YOUR SHOP PROFITABLE

CLONE-ABLE SENSORS

Standard Motor Products, Inc. (SMP) has added five new clone-able sensors to its growing TPMS sensor line. These new clone-able sensors match the original for fit, form and function, and due to their advanced engineering, they can easily be cloned with the existing sensor ID, eliminating the need for a factory relearn, according to the company. Standard part numbers TPMS115A, TPM1A, TPM27A, TPM91A and TPM107A offer expanded late-model coverage for Ford truck, Acura, Honda, Suzuki and Cadillac.

For more information, visit
www.smpcorp.com.
SMP Corp./Standard Motor Parts

TWO-POST LIFT

Direct Lift introduces a two-post automotive lift designed to give small shop owners more options than ever before. The new 9,000-pound capacity DL9 two-post lift features asymmetric arms mounted on symmetric columns. The improved arms and carriages will give users better pickup-point access and allow them to lift either asymmetrically or symmetrically, the company reports. The lift's latch covers are made of impact-resistant polymer to minimize denting and scratching. All hoses are routed internally for improved aesthetics, and the padded switch that cuts power when a vehicle reaches maximum height has been redesigned.

For more information, visit
www.directlift.com.
Direct Lift

LITHIUM-ION 3/8-INCH DRILL

ACDelco has a new, ACDelco-licensed 12V lithium-ion 3/8-inch drill to add to its growing portfolio of auto and equipment tools. With 300 inch-pounds of maximum torque, it is among the most powerful in its class, the manufacturer states. The drill (part number ARD1296) features a four-pole torque motor, 20 torque settings plus drill mode; a two-speed gearbox, variable speed with reverse and a built-in LED light to illuminate the work area. The ACDelco-licensed lineup of nearly 80 power tools and accessories includes impact, ratchet and torque wrenches, drill/drivers, polishers, grinders and work lights, all available in air, cordless and digital models.

For more information, visit
www.acdelco.com.
ACDelco

LINE-TO-HOSE CONNECTOR

The new Smart Splice Line-to-Hose Connector from AirSept offers a permanent repair with five-minute installation and no waiting for special-order OE lines. Repairs can be made often without line removal, saving labor time and increasing job profitability. According to the company, the Smart Splice Line-to-Hose Connector is based on proven, advanced seal and vibration resistant technologies that make it superior to traditional compression fittings. A new HNBR Seal Sleeve dramatically expands the metal line sealing surface area. It seals against irregular tubing surfaces and prevents leak "travel" that can defeat narrow O-ring seals. A Crimper Tool is included in the kit.

For more information, visit
www.airsept.com.
AirSept Inc.

WEAREVER BRAKES

Wearever® celebrates 25 years of providing commercial customers with quality brake pads and parts you can trust. Available exclusively from Advance Auto Parts Professional, the Wearever line includes Platinum, the best-performing ceramic brake pad; Gold, a quality OE replacement pad; Silver; and Frontline, for fleet vehicles. For the latest promotions on Wearever products, visit AdvanceCommercial.com/seasons

Advance Auto Parts

AAPEX AUTOMOTIVE AFTERMARKET PRODUCTS EXPO

REGISTER NOW FOR AAPEX 2013

You will grow your business at the Automotive Aftermarket Products Expo (AAPEX) by seeing the newest products, meeting the right people and getting answers to your important questions. AAPEX 2013 is set for Tuesday, Nov. 5 through Thursday, Nov. 7, at the Sands Expo Center, Las Vegas. To register, visit www.aapexshow.com.

AAPEX

TEXTAR BRAKE ROTORS

Textar, the world's leading manufacturer of OE brake pads, now offers a range of German engineered, high-carbon brake rotors for European applications. Utilizing the know-how that comes from nearly 100 years of developing OE brake pads, engineers at Textar have developed a perfectly matched brake rotor with Textar brake pads to ensure the ultimate braking performance of your car. This new range of high quality brake rotors are manufactured to precise German specifications and available exclusively at WORLDPAC. www.worldpac.com

WORLDPAC

PERMATEX CERAMIC EXTREME BRAKE LUBE HANDLES NOISE AND HIGH TEMPS

One hundred percent synthetic formulas, coupled with real ceramic solids, make this premium brake lubricant our longest-lasting, most temperature resistant way to silence brake noise. Effective from -50°F to 3,000°F, this product maintains its lubricating integrity under the most extreme conditions. Resistant to corrosion and contaminants, it will not wash out. www.permatex.com

Permatex

START A/C SEASON WITH A NEW LEAK DETECTION FLASHLIGHT

Tracerline® Vio-Blu™ (P/N TP-9357CS) is a versatile, dual-head leak detection flashlight that makes all automotive trace dyes glow brilliantly. It features a UV LED on one end that works best with popular PAG and ester A/C dyes, and a blue light LED on the other for fluorescing oil-based fluid dyes, including difficult-to-fluoresce yellow dyes. It comes complete with a belt holster and fluorescence-enhancing glasses. Tracer Products, www.tracerline.com.

Tracer Products

ALL-IN-ONE BRAKE PAD KITS

Magneti Marelli Offered by Mopar® all-in-one brake pad kits come complete with stainless steel hardware for easier installation and less vehicle downtime, while making brakes quiet and extending their lifetime by reducing premature wear-out due to worn caliper hardware. Available in semi-metallic and ceramic formulas, these brakes provide excellent stopping power and superior braking performance, and are compatible with all major makes excluding Chrysler Group vehicles.

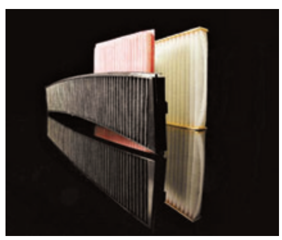
Magneti Marelli

THE ULTIMATE IMPORT WIRE

Intermotor® Import Wire Sets are unrivaled for quality, coverage and original match. No one provides more extras like factory-installed separator clips, anchors, protective loom and trays to keep wires sorted properly and safely. Intermotor wire sets install with ease for exceptional power, performance and extra-long service life. Visit www.IntermotorImport.com.

Intermotor

DENSO CABIN AIR FILTERS



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

Denso

TOUGHONE A/C PARTS

ToughOne A/C parts are performance-tested, premium products that meet or exceed OE specifications. Stringent testing ensures superior quality. Low defect rates – about half that of competing brands – mean less comebacks. ToughOne parts are available exclusively from Advance Auto Parts Professional. For the latest promotions on ToughOne products, visit AdvanceCommercial.com/seasons or call your local Advance delivery store.

Advance Auto Parts

DENSO WIPER BLADES

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

Denso

MIGHTY COMBINES TECHNOLOGY FOR ULTIMATE BRAKING PERFORMANCE

Mighty Auto Parts offers System XL® brake pads, with Noise Elimination Technology (NET), that utilize a combination of key engineering features designed to combat Noise, Vibration and Harshness (NVH). Brake pad development begins by certifying the highest grade materials, which are then pressed in positive mold cavities to ensure consistent durability and noise abatement. System XL brake pads follow OE configuration, including the use of multiple chamfer designs, slots and insulators. Friction formulations remain consistent with original equipment manufacturers.

Mighty Auto Parts

INNOVA PRO 31603

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

Innova

CLONE-ABLE SENSORS ADDED TO TPMS LINE

Standard Motor Products, Inc. has added seven new clone-able sensors to its TPMS line that match the original for fit, form and function. The Standard® and Intermotor® part numbers cover an additional 11 million VIO for Acura, Honda, Ford, Chevrolet, Cadillac, Ford truck and Toyota truck through the 2013 model year.

SMP

NAPA LEGEND BATTERIES

NAPA KNOW HOW

This July at NAPA, visit your local NAPA AUTO PARTS Store or AutoCare Center to get up to a $25 mail-in rebate on NAPA batteries, starters and alternators; and for each rebate redeemed, NAPA will make a donation to the Intrepid Fallen Heroes Fund. Give something back when you get something back, at your local NAPA. At participating stores, expires July 31, 2013.

NAPA

GABRIEL'S READYMOUNT ALMOST 200 SKUS DEEP

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

Gabriel

FEDERATED OFFERS PREMIUM SRT BRAND HUB BEARINGS FOR OUTSTANDING LIFE AND PERFORMANCE

Federated Auto Parts offers a premium line of hub bearings for import and domestic applications under the SRT brand, which deliver great performance, durability and value. SRT bearings offer leading edge design and metallurgy and are manufactured exclusively for Federated members and customers. SRT hub bearing assemblies offer original equipment designs complete with ABS sensors and seal designs that offer maximum protection from contamination and maximum durability. All SRT hub bearings are 100 percent tested to ensure reliability and performance.

Federated

BUSINESS OPPORTUNITIES

CYLINDER HEADS

PARTS & ACCESSORIES

PARTS & ACCESSORIES

POSITIONS AVAILABLE

Looking for Tech's Resumes?

16,000 + Tech's Resumes Online

looking for a job?

1000 + Automotive jobs Online

www.ACTAutoStaffing.com

800-489-0536

ACT Auto Staffing.com

PRODUCTS

PRODUCTS & SERVICES

Stop Paying Part Store Prices

Coil On Plug Sale

Part #	SMP #	NAPA #	Application	Each	8 pak
DG508	FD503	IC369	4.6L, 5.4L, 6.8L 1997-6	$23.95	19.95
DG511	FD508	IC617	4.6, 5.4L 6.8L 2005-9	$28.95	24.95
DG512	UF-537	IC558	4.6/5.4L DOHC 97-04	$31.95	27.95
DG515	FD506	IC518	3.9L Ford T-bird (05-02)	$24.95	21.95
DG500	FD502	IC386	3.0L Ford 1999-8	$28.95	24.95

Free Shipping on any 8 pack

Sherco Auto Supply 800-548-6229

Call for Catalog or Order @ http://www.autosupply.ws

TRAINING

New book by Vince Fischelli (250 pages – 198 diagrams) $78.00

"Vehicle Electrical Troubleshooting SHORTCUTS"

Troubleshooting batteries, cranking circuits and charging systems on-the-vehicle with just a DMM & Current Clamp plus a lot more!

Veejer Enterprises • 972.276.9642
www.veejer.com

SHOP SUPPLIES

AUTOMOTIVE BANNERS

Size 3' x 8' • 13-oz. outdoor vinyl • UV-resistant ink

Choice of banner & ink colors

All edges double stitched with brass grommets for display

Hundreds to choose from.
Visit our website for more!

www.PartsQueen.com

Let Marketplace Advertising Work For You!

Generate sales leads, maintain market presence, conduct market testing, promote existing lines, introduce new products and services, or recruit the best.

SOFTWARE

REPAIR ORDER PRO

Affordable desktop estimating & invoicing for all repair shops.

- Easy to use
- Free trial download* or disc
- Free technical help & upgrades to new computers
- Integrated reporting & & income management.
- Pay just $240 for unlimited use No contracts or monthly bills
- Vehicle history, stock jobs & multiline jobs.

SWAN RIVER SOFTWARE
sales@shesmylittle.com • 866.584.5556
http://www.shesmylittle.com/*

Repeating an ad **ENSURES** it will be seen and remembered!

MARKETPLACE OFFER YOU AN EXCELLENT RETURN ON INVESTMENT!

FOR MARKETPLACE OR CAREER OPPORTUNITY AD RATES/PLACEMENT:

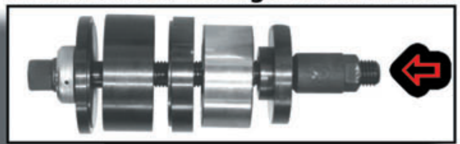
Call **Keith Havemann** at
Ph: 310-857-7634
Fax 310-943-1465 or
E-mail: khavemann@advanstar.com

TOOLS & EQUIPMENT

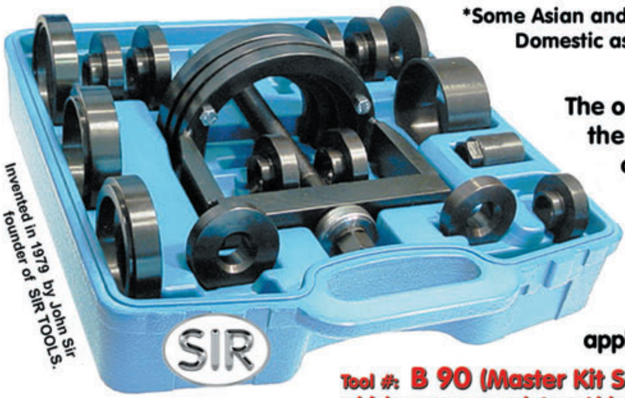
ORIGINAL HUB MASTER

REAR + FRONT + AWD EUROPEAN VEHICLES*

: Tracks Arrow-Straight Under Load :



*Some Asian and Domestic as well!



Invented in 1979 by John Sir founder of SIR TOOLS.

The original "HUB MASTER" in service since 1979 and demanded the World over by race car teams, professional technicians, car clubs and serious automotive enthusiasts. Applicable to wheel bearing/hub assemblies where power is being directly applied to that wheel from the engine. Vehicles that require the HUB MASTER are equipped with an independent suspension and a Singular Solid Roller Bearing at that wheel. The HUB MASTER is not applicable to solid/live axles or trapped bearing/hub assemblies.

Tool #: B 90 (Master Kit Shown) which comes complete w/ blow mold case.

THIS EXCLUSIVE DESIGN IS THE ONLY ONE OF ITS KIND FEATURING:

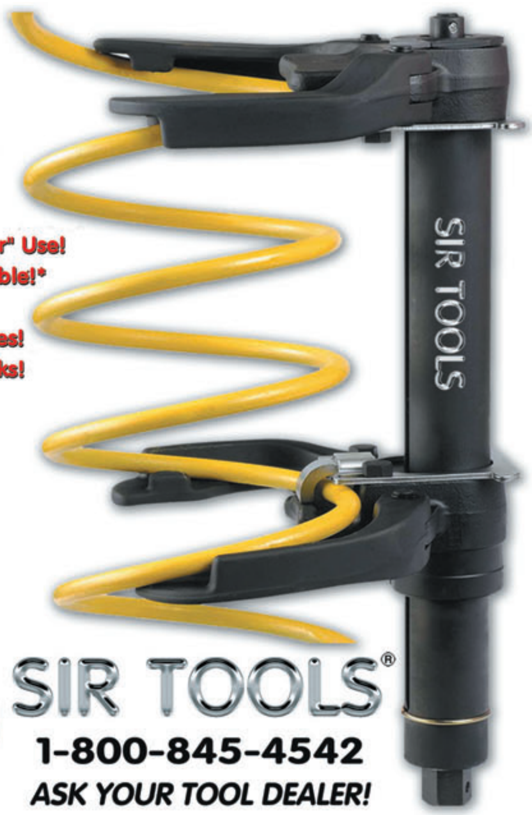
- Exclusive self-centering design which tracks arrow-straight under load.
- Easy R&R of rear wheel drive European vehicles.
- Wide application range of front wheel drive vehicles.
- Available as vehicle specific sub-kits (non master kit).
- Complete and very easy to follow instructions.
- Fully open-ended, the HUB MASTER is upgradeable to the ever changing vehicle market.

SEE IT IN ACTION ON YOUTUBE FROM SATISFIED CUSTOMERS ALL OVER THE WORLD!

WWW.SIRTOOLS.COM

PORTABLE STRUT MASTER

RELIABLE + ADJUSTABLE + IMPACT WRENCH COMPATIBLE!*



STOUT HINGED ARMS!

This Coil Spring Compressor Only Weighs 20Lbs. & is Stronger Than Most Work-Station Models!

Oliver Sir Concept
Launched 2006

- Portable for "On-The-Car" Use!
- Impact Wrench Compatible!*
- Fully Adjustable to Many Coil Styles & Shapes!
- Exclusive Coil Safety Locks!
- Completely Reliable!

COIL CONFORMING NO-SLIP JAWS!

View All Features & Specifications @ www.sirtools.com

EXCLUSIVE COIL SAFETY LOCK!

Tool #: **ST 9050**

Comes Complete With a Custom Blow Mold Storage Case!

*when operated per manufacturer's guidelines.

Optional Bench Vise
Tool #: ST 9050-BV

SIR TOOLS®

1-800-845-4542

ASK YOUR TOOL DEALER!

AD INDEX

That describes our new way of handling your inquiries about advertisements and product releases. You may go to www.motorage.com/readerservice and fill out a short form and we'll send your request immediately (electronically) and directly to the respective manufacturers who have the information you want.

You may also check the items you are interested in and fax the sheet to us at (416) 620-9790 to get more information on the products of interest.
Like we said — quick, easy, direct.

IT'S QUICK!
IT'S EASY!
IT'S DIRECT !

ADVERTISING AND EDITORIAL PRODUCT INDEX

INFO FAX NUMBER: (416) 620-9790
WWW.MOTORAGE.COM/READERSERVICE

NAME ______________________

SUBSCRIBER NUMBER FROM LABEL ______________________

JOB TITLE ______________________

COMPANY NAME ______________________

ADDRESS ______________________

CITY ______________________

STATE/PROVINCE ______________________

ZIP/POSTAL CODE ______________________

IS THIS YOUR HOME ADDRESS? ☐ yes ☐ no

PHONE ______________________

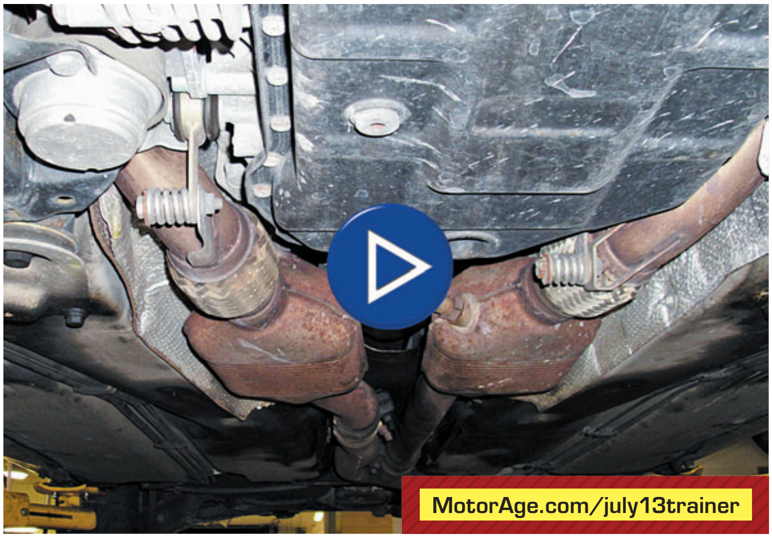
FAX ______________________

E-MAIL ______________________

CAT CODES = CAT FAILURE?

PROPER CAT EFFICIENCY CODE DIAGNOSIS CAN SAVE EVERYONE MONEY.

BY **PETE MEIER**
Technical Editor



The catalytic converter is a simple device, really. No moving parts, no periodic adjustments needed. And it serves a vitally important purpose; that is, to make sure that what leaves the tailpipe is as clean as it can be. There is one weakness to the design, though. The exhaust gasses going into the cat have to be maintained in a very narrow lambda range. Feed gasses that are too lean (excess) or too rich (excess fuel) will both cause the cat's temperature to rise outside of the limits it can handle and can cause permanent damage to the chemical substrate contained within.

And that just won't do.

The Engine Control Module (ECM) is responsible for making sure that the feed gasses getting to the catalytic converter remain within those narrow boundaries. If things get out of control, Diagnostic Trouble Codes (DTCs) are set to alert the professional service technician that his or her help is required to protect the cat. Ignoring these warnings can lead to the meltdown or damage of the substrate, excessive emissions out of the tailpipe and the dreaded P0420/P0430 Catalyst Efficiency Below Threshold trouble code(s).

Often, when these codes set, the only cure is a replacement converter. However, failure to determine the root cause of the converter' demise will almost certainly lead to the same fate for that replacement. While cats can die of old age or by impact that causes the substrate to separate from the housing and break into little pieces, those failures tend to be the exception rather than the rule. In many cases, the converter itself is perfectly fine with a long life ahead of it and the ECM simply made a mistake in its testing. In many others, failure to address existing drivability issues results in the cat's demise. And in yet others, it is our own improper service techniques that result in converter failure.

We'll cover all that and more in this month's edition of The Trainer. The Trainer is Motor Age's monthly how-to video series focusing on tips and techniques to assist technicians of all levels better themselves in the bays. And better technicians are a boost to today's shop owners. MA

JUST SCAN IT

Scan this QR Code to watch this video on your smartphone. Or visit MotorAge.com/july13trainer

GET A FREE SCAN TOOL APP AT: WWW.SCANLIFE.COM

WATCH THE HOW2 VIDEO NOW

[VIDEOS]

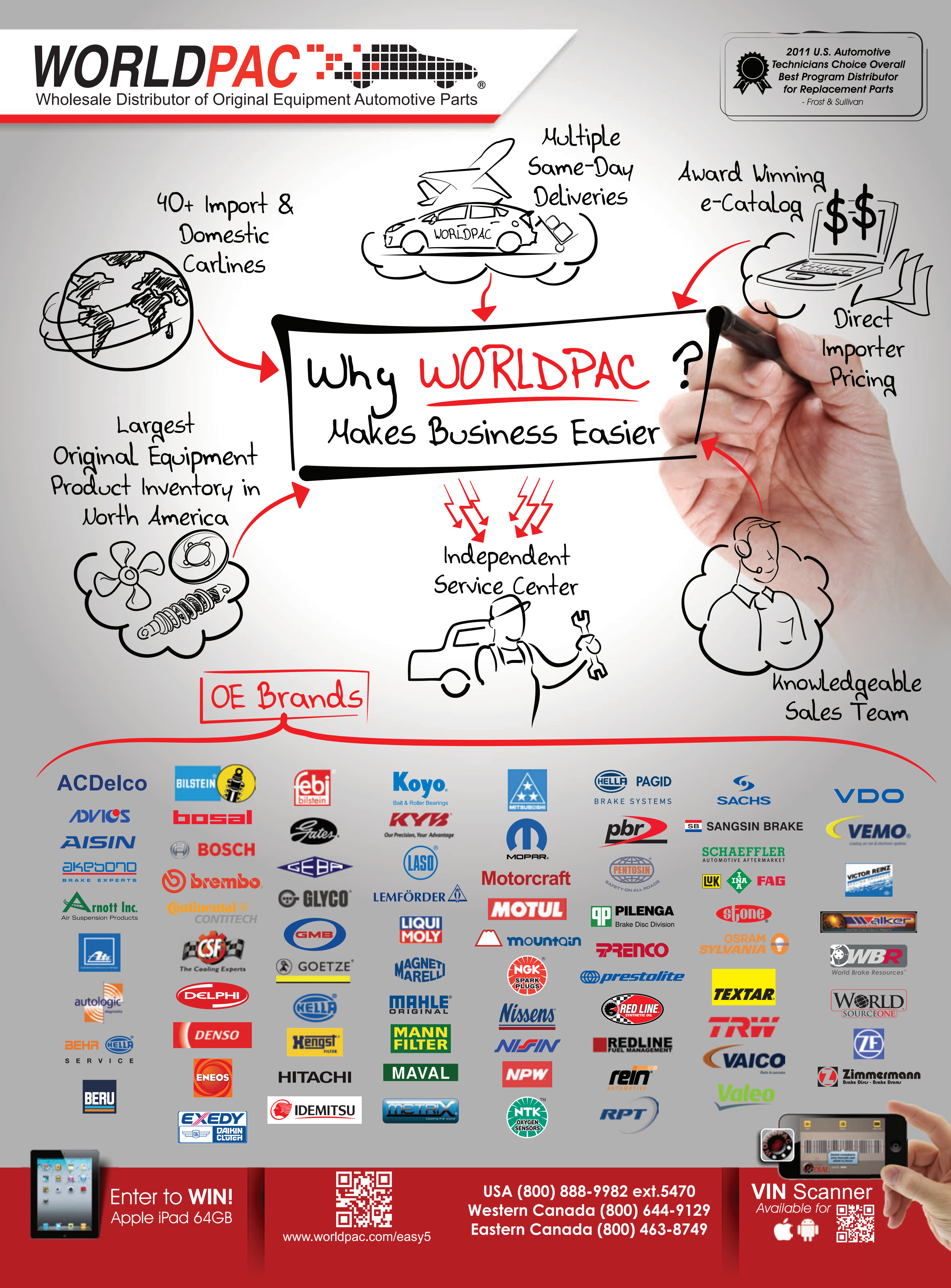
Let's say hello to Mr. DSO
MotorAge.com/june13trainer

Electrical need-to-know foundations
MotorAge.com/may13trainer

Testing battery faults (Is it even the battery?)
MotorAge.com/apr13trainer

Chasing parasites (what drains a battery)
MotorAge.com/mar13trainer


PRODEMAND
NOW WITH SURETRACK™
"CUTS THE TIME WE SPEND SEARCHING IN HALF."
ELDON DUNN
POWAY TRANSMISSIONS
POWAY TRANSMISSIONS
ProDemand™ optimized with SureTrack delivers the most complete OE repair information combined with a powerful, expert-based diagnostic resource — from a single-point lookup. So you can complete repairs faster and with more confidence, knowing your diagnosis has been verified by thousands of techs who have solved the same issue.
For more information:
Call us: 800-896-3126 | Visit us: www.mitchell1.com
Or find your local Mitchell 1 sales representative:
www.mitchellrep.com
Mitchell1®
Powerful. Intelligent. Simple.
© 2013 Mitchell Repair Information Company, LLC. All Rights Reserved. Mitchell 1® is a registered trademark used herein under license.



WORLDPAC®
Wholesale Distributor of Original Equipment Automotive Parts
2011 U.S. Automotive Technicians Choice Overall Best Program Distributor for Replacement Parts
- Frost & Sullivan
40+ Import & Domestic Carlines
Multiple Same-Day Deliveries
WORLDPAC
Award Winning e-Catalog
$$
Direct Importer Pricing
Why WORLDPAC ?
Makes Business Easier
Largest Original Equipment Product Inventory in North America
Independent Service Center
Knowledgeable Sales Team
OE Brands
ACDelco
ADVICS
AISIN
akebono
BRAKE EXPERTS
Arnott Inc.
Air Suspension Products
Ate
autologic
BEHR HELLA SERVICE
BERU
BILSTEIN
bosal
BOSCH
brembo
Continental
CONTITECH
CSF
The Cooling Experts
DELPHI
DENSO
ENEOS
EXEDY
DAIKIN CLUTCH
febi bilstein
Gates
GEBA
GLYCO
GMB
GOETZE
HELLA
Hengst
HITACHI
IDEMITSU
Koyo
Ball & Roller Bearings
KYB
Our Precision, Your Advantage
LASO
LEMFÖRDER
LIQUI MOLY
MAGNETI MARELLI
MAHLE ORIGINAL
MANN FILTER
MAVAL
METRIX
MITSUBOSHI
MOPAR
Motorcraft
MOTUL
mountain
NGK SPARK PLUGS
Nissens
NISSIN
NPW
NTK OXYGEN SENSORS
HELLA PAGID
BRAKE SYSTEMS
pbr
PENTOSIN
PILENGA
Brake Disc Division
PRENCO
prestolite
RED LINE
REDLINE FUEL MANAGEMENT
rein AUTOMOTIVE
RPT
SACHS
SANGSIN BRAKE
SCHAEFFLER
AUTOMOTIVE AFTERMARKET
LUK
INA
FAG
stone
OSRAM SYLVANIA
TEXTAR
TRW
VAICO
Valeo
VDO
VEMO
VICTOR REINZ
Walker
WBR
World Brake Resources
WORLD SOURCEONE
ZF
Zimmermann
Brake Discs · Brake Drums
Enter to WIN!
Apple iPad 64GB
www.worldpac.com/easy5
USA (800) 888-9982 ext.5470
Western Canada (800) 644-9129
Eastern Canada (800) 463-8749
VIN Scanner
Available for