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The proper care and servicing of Absorbed Glass Mat batteries.

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BY BERNIE THOMPSON | CONTRIBUTING EDITOR

Diagnostic techniques that will lead JCyou to the root cause.



#### BOOSTING ECOBOOST SERVICE

#### BY DONNY SEYFER | CONTRIBUTING EDITOR

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BY G. JERRY TRUGLIA | CONTRIBUTING EDITOR

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#### A NEW WAY TO FIND INFO

ALLDATA Mobile reinvents the way technicians access repair data.

A LOOK BACK AT C.A.N. 2014 Despite difficulties in getting there, the C.A.N. Conference was a success.

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Training was a centerpiece of Automechanika Frankfurt, and will be at Automechanika Chicago at McCormick Place.

#### AUTOMECHANIKA

### Time to get ready for Automechanika Chicago

Training opportunities are booming as the first Automechanika Chicago, set for April 24-26, 2015, gets closer.

ABRN, Motor Age and Messe Frankfurt will present an all-new tradeshow, featuring more than 120 training sessions over the three-day event. Automechanika Chicago is designed specifically for automotive collision repair and service shop owners, technicians, distributors, jobbers and more.

With the most extensive training under one roof, Automechanika Chicago provides techs and shop owners the best value for advanced training. The show boasts courses from top trainers in the industry including Dave Hobbs, Wayne Colonna, Larry Turay, G. Jerry Truglia, Skip Potter, Danny Sanchez and Bob Greenwood, along with classes from Bosch, NAPA, Redline Detection and Delphi, among others.

In partnership with TST and ATSG, Automechanika Chicago will also feature a vast selection of mechanical training courses, with new sponsors, trainers and classes being added daily.

Registration is free and just a few simple steps away at MotorAge.com/AMCregistration.

Over 8,500 automotive aftermarket shops owners and techs are expected to attend Automechanika Chicago. As a manufacturer, put your product, service or brand right in their hands by being part of this new tradeshow. Automechanika Chicago offers an extensive array of booth

[Automechanika Chicago] CONTINUES / PAGE 8

## BREAKING NEWS

#### a look at Automechanika Frankfurt

With his involvement in *Motor Age* Training LIVE, Technical Editor Pete Meier took to the show floor of Automechanika Frankfurt to see the large original show ahead of Automechanika Chicago in April 2015.

While at the German event, Meier recounted his events in blogs in our AutoPro Workshop, visiting specifically Brembo and LIQUI-MOLY.

"Even though I was there for two full days, I could still only cover about half of the event," Meier says. "It was fun to turn a corner and see an American exhibit that I was familiar with and talk to reps that I had met at other shows right here in the U.S., like the folks at Powerprobe,

> [Automechanika Frankfurt] CONTINUES / PAGE 9

CONTINUES / PAGE 9 Discussion is on-going in MotorAge.com forums

#### THERE'S MORE ONLINE:

### GEORGE'S SHELL NAMED 2014 TOP SHOP

The Fontana, Calif., shop owned by Doug Whiteman, is the 2014 Motor Age Top Shop. *» MOTORAGE.COM/2014WINNER* 

#### IATN'S NEW SEARCH ENGINE

The new platform for iATN makes it easy for premium members to find real-world answers. *»» MOTORAGE.COM/IATNSEARCH* 

#### MEMA ADVOCATES FOR UPDATED INSPECTIONS

The Government Accountability Office (GAO) soon will initiate an update of a 1990 study. *»» MOTORAGE.COM/MEMAINSPECTIONS* 

#### **ZF TO ACQUIRE TRW**

TRW Automotive Holdings Corp. has entered into an agreement with ZF Friedrichshafen AG for a nearly \$13.5 billion acquisition. *»» AFTERMARKETBUSINESS.COM/ZF* 

#### VEHICLE LIGHTWEIGHTING A SOLID TREND, OEMS SAY

Tomatoes, old Coke bottles and tiny carbon fibers are just a few of the environmentally sustainable materials OEMs are weaving into automobiles. *»» AFTERMARKETBUSINESS.COM/LIGHT* 

#### ABRN ANNOUNCES 2014 TOP SHOP CONTEST WINNERS

Mayfield Collision Centers in South Euclid, Ohio, is the 2014 ABRN Top Shops Contest winner. *»» ABRN.COM/ABRNWINNER* 

#### **BANK ON PAINT BOOTH BASICS**

One of the truths repairers operate their businesses by is that serious problems frequently have relatively simple causes. *\*\*\* ABRN.COM/BOOTHBASICS* 

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#### [Automechanika Chicago] CONTINUED FROM PAGE 6

packages at competitive prices. Exhibitors looking to reserve their booth space can visit MotorAge.com/AMCexhibitors.

Chicago is the premier destination for shops, as it is centrally located within a 500-mile radius of one-fourth of the country's collision and automotive repair shops. With two international airports, Chicago is convenient with round-trip flights less than \$350 for most U.S. cities.

Automechanika Chicago has partnered with many downtown hotels to offer attendees accommodations for many different budgets. Hyatt McCormick Place is a short walk across the sky bridge to the convention center. For those looking to stay downtown, there are many hotels that also offer a convenient jumping point to the McCormick Place direct shuttle line, allowing you to skirt those



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Occurring every other year in April, Automechanika Chicago doesn't interfere with the automotive industry mainstay tradeshows. As a biennial event, automotive technicians will receive the latest training to update their skill set within a timeframe that isn't a burden on their business.

Stay up to date on the latest Automechanika Chicago developments.

### **Canada, USA to host WorldSkills General Assembly 2016**

The world will gather in Niagara Falls in 2016.

During the WorldSkills General Assembly in Lucerne, Switzerland, Skills/Compétences Canada in conjunction with SkillsUSA were granted the hosting rights of the 2016 event.

After a productive week of discussions and decisions, the final meeting of the WorldSkills General Assembly 2014 included a presentation for the host of the WorldSkills General Assembly 2016.

Tim Lawrence, CEO of SkillsUSA copresented the bid to host the meeting and had this to say about the plans for 2016, "SkillsUSA is extremely excited to be working in cooperation with Skills/Compétences Canada to bring the world to the 2016 meeting of WorldSkills General Assembly. Niagara Falls will offer Delegates a world class meeting venue, as well as an opportunity to tap into top industry, education and government leaders and experts from across North America."

The last time that the Delegates of WorldSkills came to North America, it was for the 40th WorldSkills Competition in Calgary, Canada in 2009.

"We commend the Swiss organizers for the great work on the 2014 General Assembly and we are thrilled to be co-hosting the event in 2016 with SkillsUSA. The Assembly itself will provide the opportunity for dialogue and the sharing of best practices between national and international partners," says Shaun Thorson, CEO of Skills/Compétences Canada.

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#### [Automechanika Frankfurt] CONTINUED FROM PAGE 6

Neutronics, Ross-Tech, AirSept, Drew Technologies and several more. It was also very interesting to see that concerns faced here at home were faced overseas as well."

Common concerns include training needs, the environment and connectivity.

"Many urban communities overseas are highly congested, with Asian cities being among the most impacted. Parking is at a premium, fuel costs are high and the pollution generated by so many vehicles on the road is making air quailty a very real issue," Meier writes. "The Mobility Hall at Automechanika Frankfurt featured displays on alternative fuels and EV solutions, with many one-person cars, motorcycles and bicycles on exhibit. And vehicles on display, for the most part, were far from being prototypes with reps actually taking orders for delivery to customers next year."

Connectivity was another buzzword at the show. "Not just being able to mate your smart phone to your car's infotainment system, but the technology to operate your car using your smart phone. Or displays being built in a smart phone format that consumers are used to using," he says. "In addition to making cars of the immediate future, rolling WiFi hotspots, the technology needed to make cars autonomous was also on display."

#### **LIQUI-MOLY Visit**

Professional users require special tools. At Automechanika Frankfurt, LIQUI MOLY introduced a new assortment of service products for its Pro-Line workshop range. The purpose of development was to cover the widest possible spectrum of use with the fewest possible products. This resulted in seven new products: Electronic, Silicone, Adhesive Lubricant and PTFE Powder Spray, Ceramic Paste, Quick Rust Dissolver and White Maintenance Spray.

These seven Pro-Line service products are matched to one another to ensure that you can complete nearly all maintenance work with them alone. A few products cover the entire application range of a large number of conventional sprays and pastes. This makes your work even more efficient. These new products fulfill the most important applications for maintenance and repair. Lubricating, dissolving, separating and protecting This ensures proper and reliable function of all components and equipment. This is the result of a technical innovation: The spray head with hinged tube allows precise spot as well as large surface application, even when the can is held upside-down.

#### **Brembo's Unveiling**

Brembo is a name everyone knows. It is synonomous with high performance and racing applications, being the brake of choice for NASCAR and Indy car teams for many years. If you work on performance cars, especially highend Euro and Asian makes, you know that Brembo is also an OEM supplier to the likes of Porsche, Mercedes Benz, Ferrari and many more.

Among the news the Brembo folks had to share with Meier at Automechanika Frankfurt was expansion of its aftermarket role here in the U.S.. For instance, 22 new part numbers for Porsche were introduced as well as additional applications for what it refers to as the "Supercar" family; cars like the Audi RS4, Cadillac CTS-V, Nissan GT-R and others. Now, for these additional applications, you can get the high quality components your customers demand. And choices are not limited to high performance, as Brembo continues to expand its offerings to the aftermarket.

Another significant announcement for 2014 impacting both Brembo original equipment and aftermarket was the grand opening of its expanded North American manufacturing operations in Homer, Mich. The celebration renewed Brembo's commitment to North America with an investment totaling more than \$115 million dollars through the end of 2015, expanding the facility that houses production of brake, disc, caliper and corner module manufacturing.

Meier's visit to Automechanika Frankfurt are further detailed in his blogs in the AutoPro Workshop.



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## A NEW WAY FOR TECHS TO FIND INFORMATION

#### BY TSCHANEN BRANDYBERRY | MANAGING EDITOR

To properly repair today's complex vehicles, automotive repair shops require access to accurate repair information, and ALLDATA reports that its new ALLDATA® Mobile reinvents the way technicians access repair procedures, diagrams and diagnostic data.

ALLDATA Mobile's primary goal is to build a platform to offer a suite of integrated solutions for the automotive repair professional. The initial Mobile offering bridges the gap between automotive repair information needs and diagnostics activity generated while connected to the vehicle's onboard diagnostics (OBD) system, the company states. Using the OBDLinkMX Bluetooth adapter, ALLDATA Mobile wirelessly connects to the vehicles on-board diagnostics port, bridging the gap between ALLDATA's factory repair information and vehicle's internal computer systems.

Pairing vehicle connectivity with ALLDATA's vast database of manufacturers' repair information, technicians can now decode a Vehicle Identification Number's (VIN) and automatically access diagnostics and repair data specific to the connected vehicle. Along with VIN access, ALLDATA Mobile can read OBDII Diagnostic Trouble Codes (DTCs), and

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link the specific codes directly to the diagnostic flow chart within the ALLDATA database.

ALLDATA Mobile stores all DTC activity within a central database under the specific vehicle's VIN. If the vehicle returns to that specific shop, a technician can access any past code activity using ALLDATA Mobile within their shop. This feature is critical for tracking repair issues within specific vehicles, and provides multiple employees (from service writers to technicians) with the ability to access general information about the vehicle as well as technical information on the system needing repair.

ALLDATA says the new system helps shop owners give their employees an option to take one system from vehicle to vehicle, saving time by saving time by automating vehicle selection, quickly accessing vehicle information for diagnostics, getting clear and up close views of diagrams, images and schematics and offering paperless vehicle repairs with no need of printing out repair information.

The creators behind ALLDATA Mobile offered a series of features the product provides today's shops, including some problems they feel the product solves.

In addition, ALLDATA Mobile creators report that they understand the repair shop environment, and focused on developing a touch interface that his highly optimized for shop floor repair technicians who work in tight spaces. The matrix interface into the automotive repair information database simplifies navigation and provides more direct access to repair articles than any known similar products, they state.

For more information, visit www.alldata.com.

### A look back at C.A.N. 2014

After an adventurous time getting to the 2014 ASA Illinois C.A.N. (Chicago Area Networking) Conference, Pete Meier was able to take in the training and share his thoughts in his blog in the AutoPro Workshop.

The Chicago area is home to some of the top trainers in the country: John Thornton, Scot Manna, and Ken Zanders often being referred to as the Chicago "Wise Guys" for their reputation as talented technicians and educators. In addition to these top instructors, others were present to offer their experience and expertise to those who attended. While I unfortunately missed much of the sessions held on Friday and Saturday, those I spoke with told me they gained a lot from sessions held by Dave Scaler (MEA), Jeff Minter (Panoptic Training), Eric Zeigler and Scott Shotton (The Driveability Guys). New this year were presentations by I-CAR instructors for collision techs who attended the event. A hot topic at the recent ASA National NACE/CARS event was the processes needed for the proper repair of aluminum components that many OEMs are implementing or considering implementing in new models.

Friday and Saturday evening changed the focus from training to networking, with several companies exhibiting at the expo. These partners are an important source of support for the annual event and most booths were well attended.

But it wasn't over yet. Sunday offered additional opportunities to learn before heading home. I got to sneak a peek into some of them and couldn't help but be impressed by the passion the instructors brought to their students.

— Pete Meier, technical editor



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#### ASE GUIDES



SURVEY: Consider the routine oil change. Tech A says that only oil meeting the OEM specifications should be used, while Technician B says that all oils have to meet the same standard so anything that's in the bulk oil tank will work just fine. Who's correct?

A. Tech A B. Tech B C. Both Tech A and B D. Neither Tech A or B

Log onto MotorAge.com/ nov14survey to answer the question and enter our monthly contest from Federated Auto Parts.



### **Personal Marketing**

You can be good at marketing if you put in some time.

BY LARRY SILVEY | PUBLISHER OF CUSTOM CONTENT

recently had a conversation with online marketing expert Nathan Scripps about auto repair shops wasting their time marketing to prospects on a "one and done" basis. Scripps, general manager of MotoREV, says you should set your sights on long-term relationships. Getting customers on a schedule to return routinely is the only true ticket to success.

The problem for many shops has been they just aren't good at marketing or don't have time to give it. All too often, they leave their marketing up to word-of-mouth, which of course, is a very effective means of getting new customers; however, you don't have enough customers to carry on the conversation for you. In fact, you don't even know if they will pass the word on even if they are thrilled with your services. Other shops have used traditional media to different degrees of success, while still others have just simply experimented with the next new marketing gimmick to come down the pike. All this adds up to hit-and-miss marketing at its best.

What I'm getting at is that too many shops do their marketing by happenstance...or when it's convenient...or when business sours, which is sometimes too late at that point. Conversely, Scripps is a proponent to engage customers with a shop's brand. This is accomplished by shops conducting ongoing,

#### Motor Age.com BEST OF THE BLOGS

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-A-Flat used for butt

Tech Tip: Fuses T Won't Blo From: Peter Blog post Week ago

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

#### **Bolt On Technology**

#### Photos improve customer trust

Upping the daily car count has been an ongoing goal for Tim Steigerwalt since he became owner of six Philadelphia-area independent auto repair shops in 1996.

The challenge of "not enough cars" is a problem common among fellow shop owners.

And while Steigerwalt has not yet found the magic bullet to bring more customers through his shops' doors, he has been able to make a difference in another way.

This spring, Steigerwalt's shops incorporated BOLT ON TECHNOLOGY's mobile automotive software solutions into their daily routine. The result?

#### "Doubled revenue."

♦

In particular, Steigerwalt said his team continues to find success with Mobile Manager Pro's photo-taking and texting capabilities. Adding vehicle condition photos to a digital multi-point inspection, repair order or estimate has helped "gain the trust of the customer," he said.

In turn, customers who can visually see the need for repairs or maintenance are more likely to authorize work as evidenced in the \$60 increase in his shops' average repair order.

"It has really enhanced our communication with our customers," Steigerwalt said. "We're able to communicate with our customers in a different way." Steigerwalt, who worked for two decades fixing cars before becoming a shop owner, said the technology is something he had "never heard of" during his wrenching days.

As such, he "wasn't really sure what to expect" from it.

His customers, who now receive vehicle condition photos, along with repair orders and inspections via text and email message, have responded positively, in most cases approving repairs in minutes instead of hours.

"It gives them the 'wow' factor," Steigerwalt said.



targeted email, periodic postcards, communication via a monthly newsletter and scheduled online appointments with their customers. Throw in social media and you really have your customers hooked. But who has the time to do all of this? Well, that's the point, isn't it. You need to hire someone to do it for you. And to do it with expertise.

By engaging customers through these communication methods, Scripps says you can expect customers to return 36 days sooner on average. Read more at motorage.com/emails.

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*Motor Age* roundtable As shops move forward, education continues to be paramount, shows the theme in Motor Age's 2014 roundtable. MotorAge.com/roundtable

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comments from MotorAge's online communities

#### The best of what you're saying on Facebook.com/MotorAgeMagazine, Twitter (@Motor\_Age and @PeteMeier) and the AutoPro Network.

all over their shops they

Earl Koisa via Facebook: I have this happen every day, and my local parts supplier's all say the same thing, it the way the parts "biz" is. I have the same problem with the discount card customers and online shoppers. I have more wanting me to install their parts, so I set new labor rate in my system just for them.

Aaron Rawlings via Facebook: It make me a little mad, too, when a customer that walks into a parts store and gets a better price then I do. It boggles my mind that the retail outlets would walk

> the communityjoin the discussion

supply. I have found myself ordering parts online from a certain website, because they can walk all over the retail outlets. Their shipping is fast, and when you take your time, you make sure you order the right part from them. But their wrong part return program is a breeze to deal with, too. Just my take on this.

kliberty via Disqus: I had a 2003 Odyssey that whined like that from about brand new all the way until I traded it in

The bearing whine is just a symptom of the heat issues these struggled with and doesnt exactly indicate transmission failue as long as you still take care of the unit and change the fluid frequently. The fix to the noise would be a teardown and rebuild. but the car shifted fine otherwise and I liked the little weeeeeeooooooouuuuu it made from 1st-2nd-3rd and so on.

with 186.000 miles on

the original transmission.

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est news impacting the A/C service field. Dusting off your 5-gas analyzer Can you remember the last time you used a

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neyed to the home of Central Command, Mac-

servicing best practices and a recap of the lat-

Dill AFB, in Tampa, Fla., and discussed A/C

#### Profit Matters on air

Bryan Stasch and Chris "Chubby" Frederick of ATI joined Motor Age's Tschanen Brandyberry to discuss how to present a more professional front. It goes beyond having a clean shop, though that is a start.

FEB. 5-7, 2015 Mobile Air Conditioning Society (MACS) Training and Expo Orlando

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COMMUNITY



MOTOSHOP TECHNOLOGY TOOLS



### WHERE YOU ARE IN THE LIFE OF YOUR BUSINESS DICTATES SOME PARTS OF YOUR MARKETING PLAN.

BY LARRY SILVEY | PUBLISHER OF CUSTOM CONTENT

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

We talked to him about how to attract customers and retain them for the long term. You can watch more from Stein, and learn about MOTOSHOP's tools, in the rest of the video interview online at MotorAge. com/stevenstein.

## **MA:** How many shops are in the position to connect with shops online and what has made this necessary?

**SS**: It's definitely growing. I probably would say from personal experience, I see about 50 percent of shops beginning to adopt shop management systems. With that being said, with social media outlets like Facebook, Twitter, being able to easily connect to our customers has caused that to be necessary — keeping your customer data and trying to find ways to connect with them, especially with mobile devices out there as well. I see that continuing to grow as a trend, especially as social media becomes even more and more adaptable.

## **MA**: What is the most asked question you get from your customers about how they connect with their customers?

SS: I would say when I'm talking to shops in general, independent owners specifically, we understand that there's a limited marketing budget. They're trying to figure out, 'How do I make the most out of my marketing campaign?' They begin to ask the questions about the differences between search engine optimization (SEO) and CRM and how those two crossover. Ultimately, in most CRM tools, getting reviews and getting those onto the search engine help with that optimization. But they are definitely different. Search engine optimization helps with the new acquisition more than anything else. CRM helps by maintaining the current customer database and hoping they can take that and spread the word and gain new customers from the feedback they're gaining from that standpoint. (What is more important) depends on the phase that business is in.

## **MA:** What do you tell customers who say they're doing just fine with word-of-mouth advertising?

**SS:** Word of mouth is still a primary (tool), especially in this industry. I grew up in a shop and I know how important it was and how word of mouth could spread. The key thing about now is social media outlets are becoming more

easily available to anyone. We've got to get word of mouth online. It's not like we're removing word of mouth, we really need to understand that a review or something like that is what word of mouth is. To attract new customers through word of mouth, that's why it's important to get your reviews online. I usually use the example of this. Younger people are getting into a car, me telling someone, 'Hey, you should go try this restaurant or this business or this whatever,' it usually comes back that they're going to verify me. ... It's one of those things where word of mouth is still important, but you want to pull from multiple people at one time to verify that.

## **MA:** How does MotoREV fit into a market laden with technologies that send reminders and alerts them to potential problems?

**SS:** Telematics has defeinitely grown. It's a great technology to be able to remotely tell what's going on with a vehicle. As of now in the aftermarket industry, I haven't seen it begin to sync in as far as customer retention or new customer acquisition. ... At this point we send out the estimates, very accurate estimates of when customers are due for service. Down the road, telematics will allow us to do that with the customers. ... Ultimately the goal is to get them into the shops that can take care of them. **Z** 

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NEW PLATFORM Kukui unveils its recent repair shop marketing platform upgrade with new metrics. WHO'S RESPONSIBLE? Tech productivity falls on everyone's shoulders, but you can ease the load. /oroductivity

SHOP LEARNING As shops move forward, education continues to be paramount, our roundtable says.

## THE VALUE IN PARTS PARTNERSHIPS

SUPPLIERS TODAY NOW REALIZE THE IMPORTANCE OF BACKING UP WHAT THEY DELIVER TO YOU IN THE BOX.

BY **BRIAN CANNING |** CONTRIBUTOR

**THERE** is a saying that price is what you pay, but value is what you get, and that is very true in the automotive parts world these days. Many manufacturers are aware that shops want more than just quality parts; they want to know that the manufacturer will back the parts with training, warranties and ownership should something go wrong.

Around 10 or 15 years ago, we saw a very dramatic increase in the number of off-shore brake rotors and brake drums making their appearance in the U.S. market and on the shelves at many of our parts stores. Besides the fact that many of these imports were challenged by look and feel (they really looked terrible, both the unit and the packaging) even more significantly, they often didn't fit. That shockingly low price

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**"SALES SUPPORT FROM A PARTS MANUFACTURER** RUNS DOWNHILL, BUT UNLIKE SOME OF THOSE OTHER THINGS THAT SLAM INTO YOU STANDING AT THE BOTTOM OF THE PARTS DISTRIBUTION HILL. QUALITY SALES SUPPORT FROM A PARTS MANUFACTURER CAN ENHANCE YOUR EFFORTS TO SERVICE YOUR CUSTOMER."

#### BRIAN CANNING [CONTRIBUTOR]

was less impressive when the part inside the box wouldn't or couldn't bolt up. This rough start put a lot of us off, and because of these significant issues and a general reluctance to risk our name and our customer's good will, many of us just said no to these cheap imitations and continued to buy the more familiar, more expensive alternatives.

In fairly short order, the products began to look better and bolt up with reasonable ease, but what got many of us finally buying these much cheaper alternatives was the willingness of the warehouse distributors, and thereby the jobber stores, to

stand firmly behind these products, offering sales support, buying incentives, training and even labor claims to give confidence to the shops that were so bold as to actually install one of these parts. Low price is

one thing, but a manufacturer, warehouse distributor or jobber standing behind a product is something else entirely. When your reputation as a shop is on the line, standing out there by yourself is a pretty scary proposition. But standing out there with an entire parts distribution chain standing with or behind you gives you the confidence to move forward. That confidence drives and assures selling success.

There is no doubt that having a quality part in the box is where it all begins, but often what will set one brand apart from another is what comes with the purchase of the part. No matter what manufacturers tell you, nobody has yet developed the perfect part, that will always do what it is supposed to do for as long as it is supposed to do it and often, it is what comes with the part and who is standing behind the part that matters the most. If I have a bulletproof part that never wears out or fails but whose manufacturer offers only a partial line or limited coverage and an inferior warranty, I might find myself tempted to go with an alternative, exchanging quality for sales support and better availability. Quality not only is a question of engineer-

ing; support after the sale,

provided training, labor policy and availabil-

See what fellow shop owners had to say about what's in the box when a panel discussion addressed the topic. MotorAge.com/ inthebox

ity can all come into play. Some manufacturers pack a lot more into that box than just the part, and in today's market, with today's vehicles, that matters a lot.

If the part in the box was all that mattered. I am

guessing that Amazon probably would be the largest automotive parts distributor in the country. But of course all that goes (or could go) with the part is what separates one manufacturer from another and should be a big part in determining who you buy your parts from.

Many years ago, I worked for a very large remanufacturer of starters and alternators. In the market surrounding Baltimore and Washington, D.C., these guys were by far the most expensive line of starters and alternators out there. But at the same time. they offered a product of recognized quality, they offered consignments and they offered product availability



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far beyond what any other distributor could touch. Along with this, they provided ongoing training and support after the sale that made it a very easy decision for a great many shops to make. Branch managers were given a great deal of latitude and flexibility in handling warranty claims, and if we needed to pay labor, we paid labor. If we needed to pay towing for an out of town failure, we paid towing.

Along with all of this, this company scrupulously trained their people and made sure anyone coming into contact with customers knew the product and knew all the resources that were available in supporting the sale. The part inside the box was without a doubt a quality part, but what sold that part was everything that went out the door with it. When you bought one of these starters or alternators, you also bought the quality people and the company behind it.

Like other things in life, sales support from a parts manufacturer runs downhill, but unlike some of those other things that slam into you standing at the bottom of the parts distribution hill, quality sales support from a parts manufacturer can enhance your efforts to service your customer. The manufacturer, through the warehouse distributor and jobber, wins when you buy their parts.

Your first step towards a win as a shop owner or service manager comes when you can get a quality part, at a competitive price, delivered in a reasonable amount of time, with the opportunity to service that customer again in the future.

What solidifies and assures your win is the value that comes with your purchase. If that manufacturer is providing training, technical support, has great coverage, a generous warranty or labor considerations, sales support or an advertising allowance, you would seem to have a partner in your shop's success. If that manufacturer provides you with a quality part in a pretty box but not much else, you are most likely on your own.

The normal supply chain in the

automotive parts world has the manufacturer at the top and you, as an installer, at the bottom with warehouse distributors and jobbers in between. There has to be a win in it for everyone. If you are having trouble seeing or feeling the win, maybe you are dealing with the wrong manufacturer or wrong distributor or wrong jobber.

What separates quality auto parts manufacturers is not the part in the box: it's what comes with the part that makes the biggest difference.  $\mathbf{Z}$ 



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 multistate sales territory for an independent manufacturer of automotive parts.

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PROFIT MATTERS

**HOW DO YOUR NUMBERS LINE UP?** 

## **SHOW ME THE MONEY**

### MONEY COMES IN MANY FORMS, AND YOU NEED TO LOOK BEYOND THE P&L FOR IT.

#### BY CHRIS "CHUBBY" FREDERICK | CONTRIBUTOR

And if you did earn it, where have been times that you didn't think you had earned. And if you did earn it, where had the cash gone? I was listening to one of our coaches, Brian Hunnicutt, explain to a shop owner where the money might have gone. This shop owner was not feeling the money in their wallet. According to their profit or loss statement, they were doing great. So where is the money?

This is not as uncommon as we think. Most of my clients were technicians, not accountants, before they opened the doors. So it is not a big stretch to think of a shop owner sitting at their desk, seeing that our financials show one thing and the checkbook shows another.

#### **Take Inventory**

We have to know what we started with and where we are now. If you have increased your inventory by \$50,000, then it won't be in your checkbook. How many parts have you not sent back that have become inventory by default? How many credits have you not tracked from the vendors? Do you have a way to manage your parts to make sure they don't become inventory, or worse, grow legs and walk off? Are you keeping a rolling inventory going, where you check a couple of different line items a week and do it in front of the crew? Do it loud and make a big deal out of it when the count is right or wrong. How many parts are being put on vehicles that don't find their way to the invoice?

Another take on this is parts that the employees, friends and family get their hands on without reimbursing you for them. An air filter or an oil filter, five quarts of oil, a hose clamp, the antifreeze to go with it. All the little items



that you have such a hard time charging the customer for that are listed under shop supplies — those are the same items that the people around you take from you without even thinking about it.

#### Look at Your Receivables

What about account receivables? Once again, what did we start with and where is it now? Have we written anything off or has the number just gotten bigger? Are we carrying any of our good customers? You know the ones that have always been good for it.

I had one of my people actually tell me that after a year and a half and more than five different repair tickets, the customer when asked to pay said, "I don't have any money." To which my guy responded by asking why she had him keep fixing the car. She answered that since he kept fixing it for no money, it must have been OK to not pay. Back on track, what did you start with and is it bigger or smaller?

#### **Stay Focused on Margins**

Margins always seem to sneak up on us as well. The normal client starts out with a 25 to 30 percent parts margin and not getting very much if anything on shop supplies. Then we get them up to 50 to 55 percent, and the relief to the checkbook and comfort zone is great. Time passes and they take their eye off the ball. Then they themselves or the service writer starts getting retrained by the customers to discount or just not charge as much, and we are right back into not as much money.

Think about the 80/20 rule and the eight out of 10 customers in a normal shop that do not buy; most of them say their reason for not buying is that they do not have the money. That is the No. 1 objection that my people hear on the front counter, because it is designed to get you to back off of them and not hold the line on the sale. It also trains your writer to not ask for as much or as hard, cutting the margins along the way.





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#### "WHAT IS THE BEST WAY TO MAKE REAL MONEY IN A SHOP? THE OWNER HAS TO STOP TURNING WRENCHES, SELLING SERVICE AND WORK ON THE BUSINESS, NOT IN IT."

#### CHRIS "CHUBBY" FREDERICK [ATI CEO]

Back debt seems to be the biggest one we deal with. I have had a client who paid off more than \$220,000 in back taxes, debt and fines, and could not find the money he owed the back taxes on. It seems that money that does not drop in the checkbook is not money at all sometimes. Money that is in a shoe box, buried in the back yard or sitting at the college with the kids is not money either.

The new car or the new equipment is not money as well. In one instance, the new plane that went with the new boat was not money. But when I had a shop owner park the new Diesel Pusher Motor Home at the shop and complain about business, the motor home was not money at that point. Your customers think they paid for all that stuff, and they are right, so don't flash it around them.

If you are not feeling the money, please look into your profit or loss state-

ment and see if the fixed expense has gone up. Also take a good look at the money your people are now making versus what they were making. Look at your inventory on all its different levels. Look at your account receivables, and see if you are not footing the bill for your customers. But most of all, look at your back debt and see if it has shrunk at all. Then for good measure, look at your lifestyle and your kids' lifestyle and see if maybe the money is there.

#### Many Shapes and Sizes

When all is said and done, and you want the money, remember it comes in all shapes and sizes. You should make sure you have an emergency fund set up as well, and that it is big enough to choke a horse. Then never touch it.

We have a very useful checklist that could help show you where the money

is, or in the worst case, give you ideas on how to create more cash. For a limited time, you can receive your own copy by going to www.ationlinetraining.com/2014-11.



Chris "Chubby" Frederick is the CEO and founder of the Automotive Training Institute. ATI's 108 associates train and coach more than 1,250 shop owners every week across North America to drive profits and dreams home to their families. Our associates love helping shop owners who are having the same struggle as many of them have had, and who are looking for the same answers – and in some cases looking for a lifeline. This month's article was written with the help of ATI Senior Coach Brian Hunnicutt.

 $\equiv$  E-mail Chubby at cfrederick@autotraining.net



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## OPERATIONS

## **SO YOU OWN A SHOP, NOW WHAT?**

### THERE ARE SOME STEPS TO TAKE TO PREPARE YOU TO PUSH YOUR BUSINESS AHEAD.

BY BOB GREENWOOD | CONTRIBUTOR

ravelling all over North America, I have the privilege of talking with hundreds of service shop owners each year. I must admit though, I usually see the better shop owners as the other owners out there who seem to be preoccupied with hunting and fishing, not the ones who are too busy to deal with staff problems or who don't care about learning how to run a business. Those others say, "That's bookkeeper stuff; I'm a mechanic, that is why I hire a bookkeeper."

It is this last point that I would like to bring to your attention.

I have talked with a number of shop owners and a number of part suppliers about this issue, asking the question, "Why do many shop owners today not want to learn about the business end of their shop?" There has been a common point of view coming to the surface.

It appears the technicians who own these shops, first and foremost, are pretty decent technicians. He appears to be morally in check in that he really wants to do the job right and try to serve the customer well. He had this desire to be self-employed from a pride/ self-esteem point of view, coupled with seemingly having the perception of available perks and flexibility of owning his own business. He feels that if he is a good technician, word will get out, the business will look after itself and he will enjoy a good living doing what he likes to do the most - working on vehicles in the back of the shop, diagnosing and fixing them.

Many of these shop owners will make the comment, "I don't need management training, because I have a book-



keeper that looks after that stuff. I fix cars — that is what I do." The shop owners I talk to over the course of a year point out the very reality of this mind-set has created the following problems:

1. All bills of the shop are not paid in full each month.

2. Accounts receivable are too high and are out of control.

3. This shop has too high of debt load for its size, a poor banking relationship and sees his accountant once a year, because "he has to."

4. This shop runs its business first on being price competitive, second on specials and always on cheap oil changes to create traffic through the bays in order to find work.

5. This shop always will sell to anyone who comes through the door because they actually believe if sales are up, they will be more profitable. 6. This owner feels uneasy when the shop is not busy.

7. In the northern states, this shop owner looks forward to a cold winter and hot summers, which are the main ways he judges if he is going to have a chance at making some money.

8. This shop owner has a staff making more money on the weekly pay check than he does.

9. The relationship with the shop's jobber is one of non-business communication and only one of "give me your best price." There is absolutely no trust between the two parties.

10. This owner complains frequently about his staff as he thinks good staff costs the business money.

11. This owner loves to pocket cash jobs on Saturdays in order to have some spending money and get by, thinking he has a way of beating the government. 12. This shop is not clean, not organized, not progressive, is under equipped, under stocked and the owner seemingly blames anyone but himself for any problems the shop has.

These are all serious problems, but the fact remains that they have nothing to do with diagnosing and fixing vehicles. They are all caused by the owner not really understanding how this business should be run today. Keep in mind that back in the 1980s, this sector of the industry made money despite ourselves, and if Dad made his money back then and is insisting that the business be run the same way, then in the end, the new owner will just end up buying himself a job, or potentially go under, and create tremendous financial hardship to the family. This isn't worth it, and it would be better to sell the business, get rid of the stress and go work for someone else where he will be in a situation of making a fine living without the financial risk associated with this business today.

The final point that creates this overall problem seems to be personal ego in the sense that the owner feels he was not that good at math in school, and might not understand the real business end of things that would lead him to be put into an embarrassing situation in front of his peers in that business management class. Any professional business management instructor who did that would be out of business real fast.

There will be a number of shop owners who read this and say the writer doesn't know what he is talking about, but please remember one thing: Your peers that mentioned this stuff to me, I'm just reporting to you.



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Weak independent shops are affecting the very livelihood of independent shops around them. It is time that all independents talked with each other and figured out that maybe learning "how" to run this business would be time well spent in order to create a better personal lifestyle, less stress and a better overall operating shop for this entire sector.

As we close another year, perhaps it would be prudent to make the effort

and take a chance at this "business management stuff." There are many courses available within our industry. Check with your jobber and your industry associations, as they can find out what courses and where they are available. Consider that "excuses are the nails that build the house of failure," and perhaps it might be worth it to make a resolution this New Year to be a good listener for once, as your ears will never get you into trouble. **Z** 



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SHOP MANAGEMENT | BEST PRACTICES

#### **OPERATIONS**

SHOP PROFILE

A snapshot of one of the industry's leading shops RAMSEY'S RODS & RESTORATION / FORT WORTH

## Old Fashioned in a New Way

Breathing new life with new methods keeps these older vehicles on the road.

#### BY ROBERT BRAVENDER | CONTRIBUTOR

n the history of Top Shop submissions, rarely, if ever, will you find a restoration/custom shop in the running. This didn't stop Stephen and Denise Ramsey from putting Ramsey's Rods and Restoration into the hat, since they have a unique niche market backed up by a strong operational philosophy.

"I didn't start this to make a profit," comments Stephen. An avid car collector in the Dallas/Fort Worth area, he tried in vain to find any shop that would work on his cars in a timely and efficient manner, so he opened his own. But word quickly spread through the local collector car community, and soon he had a solid client base. It was this point that Ramsey had an epiphany.

Due to the sheer size of the Dallas/ Fort Worth market and a temperate climate that allows nearly year-round cruising, quite a few collector and antique cars are driven on a regular basis. And all those vehicles need maintenance and repairs, particularly from someone who's knowledgeable and caring about these older rides. Ramsey had discovered an untapped market.

"Who repairs the rear end on a Chevelle anymore?" asks Adrian Britton, Ramsey's lead technician. "Who wants to do a tune up on a '68 Challenger? How does someone get their '36 flathead Ford fixed? No one wants to do the basic repairs on these antique and classic cars anymore. We don't just take a car apart and rebuild it. We've got the guy who shows up in his '55 Skyliner when his power seat doesn't work."

"I realized that people are not opposed to paying good money — as long as the work is performed," Ramsey observes. "Charging a set fee to make a profit was not the goal, it was the end result. I'm now profit-driven, but I'm also geared to take care of the customer and the car. We have a unique concept in restoration, and we took it to the next level by giving the customer the benefit of the doubt on all issues; and by making the car the primary focus, paying for labor that was addressed directly to the vehicle, not necessarily to outside expenses."

Because there's no estimation program configured for older cars and old rate books would be wildly out of date, projects fees are handled strictly on an



#### **AT A GLANCE**

**Ramsey's Rods and** Restoration Shop name Stephen & Denise Ramsey Owners Fort Worth, Texas Location Number of locations 34 Years in business Number of technicians 8 Number of employees 9.200 square feet Shop size Number of bays 8 Average vehicles per week **Billed as needed** for custom repair work Average weekly repair ticket ASE, I-CAR Affiliations THE 2014 WINNERS APPEAR

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hourly rate. "We do not estimate, there are no estimates given," Ramsey affirms. "The level of trust that's between a restoration shop and the consumer base is the most important thing. We have a unique policy on parts: customers can put a credit card on file, and we charge the parts directly to their card, which eliminates markup on the parts."

"Every Thursday evening or Friday morning we send out emails with photographic progression of what's happening with every customer's vehicle. The advent of technology like the digital camera has been great." – Adrian Britton

"Our techs understand these automobiles; they grew up fixing them," Britton states. "My very first tune-up was a 421 Pontiac Bonneville. We're real conscious of what we're doing. These cars are now so well kept and maintained, you find yourself worrying about the clothes you're wearing as you lean against the paint. It goes way beyond what's normally done with just putting





One view of the shop's show room floor.

down a paper floor mat or seat cover."

Britton has two technicians for these projects, one dedicated almost exclusively to repairs, the other assisting off and on as needed. Besides basic maintenance, they also perform upgrades and installs like Freon conversion, drum to disc brakes, modern overdrive transmissions and factory crate motors. Other techs handle body work for full restorations, and have their own section of the shop with a paint booth.

"I would say that 30 to 40 percent of what we do is antiques," Britton estimates. "The rest probably fall into the muscle car category or are turned into pro-touring cars (usually muscle cars with improved handling). Every Thursday evening or Friday morning we send out emails with photographic progression of what's happening with every customer's vehicle. The advent of technology like the digital camera has been great. Our digital card gets filled up because we take pictures in the extra large format, 4 to 6 megabytes, so we can blow them up a lot without pixel distortion."

This technology also aids in locating parts when part numbers are no longer available. "I take digital photos of something that is broken or bent," Britton explains, "or I go to someone I know has the same vehicle, and I use Adobe to insert arrows pointing to what I need. The Buick museum in Michigan has even contacted us because we have 1400 photographs detailing the dismantling of an original 1953 Skylark."

Surprisingly parts availability isn't much of an issue these days; there are many aftermarket manufacturers that cater to classic cars — sometimes even using OEM tooling — most parts can be obtained new. What can't be bought new or used may have to be reproduced, and to that end Ramsey's has a network of machine shops.

"We have a specific belief we give our customers: nothing in this building waits to be worked on," Britton points out. "If it's not to be worked on for two weeks, it will sit at you house for that time. We don't stack cars up; your money doesn't pay for a car that just sits in the building. We have paperwork which outlines the scope of the work. If the customer wants to change that scope, they sign an amended contract. You need to have accountability and people



Lead technician Adrian Britton works on a vehicle.



Because of the nature of the work, the breakroom and waiting area are shared.

need to understand that you respect who they are, and more importantly you'll respect the job that you're doing and stand up for it."

This stringent system is the purview of Stephen's wife, Denise. "Our bookkeeping is very extraneous because we don't use any type of software system," she explains. "It's hands-on, lots of paperwork, but the customer can look at their folder — sometimes an entire bin once we get done with a car. But we have every receipt, every time card, everything is documented. Our biggest thing is to make sure that we're being cost effective with the timeliness of the shop, with the money they're paying us, and that they're getting quality workmanship; we don't undercut anything to lose the integrity of the build or the vehicle."

The Ramsey's new take on old fashioned repair might just take them to the top.  $\overline{\mathbb{Z}}$ 



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.

**≢=**<sup>7</sup> Email Robert at rbravender@comcast.net



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## Can you feel the heat?

### THINGS ARE HEATING UP IN THE TRANSMISSION AS TECHNOLOGY CONTINUES TO ROLL ALONG.

BY **WAYNE COLONNA** | POWERTRAIN PRO PUBLISHER

**IF YOUU** have lived life for any reasonable length of time, you have come to learn that technology in general waits for no one. It seems that as soon as you buy a new electronic device, the next day there is a new and improved version being marketed.

It is the same with today's vehicles. They have become a self-contained mobile network offering up a wide variety of services such as personal comfort, hands free communications, safety via airbags, ABS and traction control, custom tailored shift feel and scheduling and the list goes on. We've gone from having two-speed automatic transmissions controlled mechanically and hydraulically to nine- and 10-speed transmissions being completely computer controlled. Once you buy a new car with 10 speeds, the next year it will have 12! It's crazy and at times it seems as if it is getting out of hand. But it has become the norm in the days we live.

When it comes to automotive repair, and in particular automatic transmission repair, being on the diagnosing and repairing end of this increased technology is an incredible challenge. When some unexplainable malfunction occurs with the way the computer controls the transmission, it can become a real nightmare on several levels. You feel the heat from the customer who wants their vehicle and all the while you are not getting paid for the many diagnostic hours you have put into to resolving the problem. When it is discovered that a hidden corroded connector was the cause of the malfunction, then what do you charge?

Another way this type of heat can be felt is with a sensor malfunction that for one reason or another does not set a code yet alters system operations. One such device is the Transmission Fluid Temperature (TFT) Sensor. Back in the day when transmissions were not computer controlled, this sensor did not exist for obvious reasons. But when they did make their first appearance, the use of this information was quite limited. Actually, if I remember correctly, they began as a switch and quickly upgraded to a sensor.

Generally speaking, the computer would use this information primarily for converter clutch control. Once a predetermined temperature level was reached, the computer would apply the converter clutch. As each manufacturer began to use these sensors, they each had similar reasons but they also introduced their own unique programming.





#### WAYNE COLONNA

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For example, soon after TFT controlled converter clutch apply hit the streets, they began to have a limited effect with shift scheduling. Some would prohibit high gear when cold while some would also delay the upshifts. One reason for a delayed up-shift when cold was to heat up the catalytic converter a little quicker. As technology advanced to the place where pressure inside the transmission became electronically controlled, temperature information influenced the control for this as well.

Fast forwarding to today's clutchto-clutch six-, eight- or 10-speed skip shifting transmissions, the TFT sensor now has a broad range of influence and affects. Manufacturers use it for a variety of reasons utilizing different methods, strategies and self-system checks. They compare Engine Coolant Temperature Sensor readings with the TFT sensor; they compare it to calculated "in gear" engine run time; they may utilize two TFT sensors, one as a main input while another is redundant. Or one monitors sump temperature while the other monitors converter temperature. As a side note, in some applications Ford has deviated from the TFT sensor being the primary input for converter clutch control and is using a cylinder head temperature sensor instead. This is just another example of a different strategy and control by a manufacturer.

Besides shift feel, shift scheduling and converter clutch control, the TFT sensor plays a role in a variety of failsafe controls which too is manufacturer dependant. Transmission temperature is critical, not only for the life of the fluid itself but it ultimately increases the life expectancy of the transmission. Heat is not a good thing for the engine or the transmission, and so great measures are taken to control both. If the engine is overheating, the converter clutch may not apply to prevent the engine from being under load. Likewise, if the transmission is overheating, the converter clutch may stay applied longer in an attempt to cool it down. Again, each manufacturer has its individual programming strategies offering up different methods in accomplishing similar temperature control.

One transmission that comes to mind which utilizes transmission fluid temperature for a variety of different reasons is the 45/545/68RFE RWD transmission in Dodge, Chrysler and Jeep vehicles. In fact the strategy used in these transmissions date as far back as 1989 when they came out with the 41TE (A604) transmission. This transmission didn't have a TFT sensor originally, so it utilized calculated in gear run time since start, ambient temperature and ECT to determine TFT. They would then place the transmission shift logic into one of the following categories: Extreme Cold, Super cold, Cold, Warm and Hot. Shift logic then varied to match the condition of the weather and the temperature of the fluid. Much of this same strategy is in the previously mentioned rear wheel drive transmissions.

They do use a temperature sensor, which is inside the transmission range sensor. They added another shift logic category to the five just mentioned called Overheat. What is quite helpful is that Chrysler offers the description of what to expect with each of the five temperature related shift logic. Extreme cold means anything below  $-27^{\circ}$  C (16° F). The transmission will have reverse, 1st and 3rd gear only in Drive, 2nd only in manual 2 or L and no converter





clutch. To the extreme, "Overheat" which means TF temperatures above  $115^{\circ}C$  (240°F) or Engine Coolant above  $118^{\circ}C$  (244°F), the computer will delay the 2-3 and 3-4 up-shifts. Full converter clutch apply will only be available in 3rd gear from 30 to 48 mph with partial apply capabilities only above 35 mph.

Because this is a clutch-to-clutch shifting transmission, adaptations are a part of the computer strategy which can be observed in data parameters called CVI, Clutch Volume Index. After repairs, there is a scan tool option called Quick Learn that allows the computer to quickly determine the approximate volume of fluid it takes to apply a clutch. The vehicle then needs to be driven for it to fine tune quality learned shifts. For a particular objectionable shift, there are specific learning procedures that must be performed according to specific temperatures. For example, the procedure to learn a smooth P/N to Drive shift must be performed with temperatures between 27 to  $43^{\circ}$ C (80 to  $110^{\circ}$ F). Yet to perform a learn procedure for a smooth up shifts temperatures need to be above  $27^{\circ}$ C ( $110^{\circ}$ F).

There is no doubt that the TFT signal has become an intricate part of the operation of transmissions today on so many levels. As important as this sensor is, it is so often times overlooked when they malfunction and do not set a code. The variety of problems they can produce can drive you crazy. Improper clutch adaptations, line pressure con-





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trol and shift scheduling are all up for grabs. Delayed engagements, late shifts, flared shifts, hard shifts, and a loss of high gear and/or TCC operation crop up and can be intermittent to boot.

It does help when there is a code or a message display that clues you in. Some Range Rovers have an over-temp strategy that initiates when it sees ATF temperature exceed a preprogrammed threshold. Once initiated, the driver will notice late shifting and perhaps a sudden neutralizing during highway driving along with a Transmission Overheat message appearing in the instrument cluster. The overheat problem in this case is typically caused by a failed radiator where the lower eight tubes supplying coolant to the transmission cooler gets restricted preventing heat dissipation. The over-heat temp strategy designed to cool the transmission is done by significantly increasing the speed of the shifting points in order to keep engine rpm and cooling to an optimum.

BMW 3 and 5 series have a thermal bypass valve above the heat exchanger (Figures 1-3). When this fails causing ATF temperature to increase, a strategy kicks in that extends the shift patterns as well as prohibiting a shift into high gear (5th). This may or may not set a code.

Late model Hyundais such as a Sonata with low mileage starts having harsh engagements into gear described by the driver as a clunk followed by a sudden surge in forward or reverse. Intermittent harsh shifts, some worse than others may accompany the complaint and may or may not set any TFT codes yet the sensor is bad.

There are two temperature sensors used on AS68RC transmissions in Dodge incomplete chassis vehicles behind 6.7L diesels. Depending on which sensor fails, the transmission might experience an early full apply of the converter clutch. This complaint may also be accompanied with no PTO operation. Or, the complaint is a loss of 5th, 6th and TCC apply.

TFT Sensor A is located in the valve body sump area as seen in Figure 4, while TFT Sensor B is located in the To Cooler fitting on the transmission (Figure 5). TFT Sensor B monitors converter out temperature which is typically hotter than the sump which TFT sensor A monitors. If an overheat signal is sent to the TCM, the computer strategy is to fully apply the converter clutch at slightly above the 1,200 rpm range. PTO is also disabled. Likewise, if the sensors provide a cold reading to the TCM, the computer strategy is to prohibit 5th, 6th and TCC apply function.

When one or both of these sensors malfunction a diagnostic trouble code is suppose to be stored. The problem is that there have been reports of these sensors failing and causing the effects, yet the TCM does not set the codes making the cause of the malfunction elusive.

One way to inspect a possible TFT sensor issue is to compare scan data temperature readings and/or gauge readings (Figure 6) with an actual reading using an Infrared Thermometer Gun on the transmission pan and cooler out line. If the high temperature reading appears to be valid then there is a transmission malfunction. Overheat issues can be caused by a defective torque converter, a defective pump (turned stator shaft), or a problem in the cooling system, such as a malfunctioning thermal bypass valve (Figure 7), heat exchanger (Figure 8) or radiator.

If the reading taken by the thermal gun is normal yet the scan tool reports a much higher temperature, an electrical malfunction has occurred either with the sensor itself, the wiring or the computer. At this point the TFT sensor wire can be checked with a volt meter (Figures 9) to compare the voltage value with the actual temperature reading.

Typical voltage range is as high (cold) as 4.94 volts to as low (hot) as .078 before the computer should set a code. If the voltage matches the temperature reported there is a defective sensor or wiring. If it matches the thermal gun conflicting with scan tool or gauge data, there is a computer issue. In situations like this, there may be a day when working on a vehicle that you might discover a resistor placed into the TFT sensor circuit. This is a practice done to fool the computer into thinking temperatures are lower than they really are.

As a closing tip, for those that have heavy duty trucks and work them hard, for additional cooling to help keep transmission fluid temperatures down, take a look at custom pans, such as those from PML. **Z** 



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# RANSMISSION?

## TRANSMISSION COMPLAINTS AREN'T ALWAYS CURED BY A TRANSMISSION REPAIR.

always get a kick watching the workers at a fast food burger joint put their food together. I don't think the words "cooking or preparing" are terms that should be used with this process. I refer to it as "food by the numbers," where the people working can take a few different pieces of food, put them together in a certain order which will come up with something that looks and tastes like a sandwich, or something we have been led to believe is a sandwich.

At times, I feel like the automotive technician of today is expected to work and perform in this same manner. Diagnostics by the numbers will work at times, but when the diagnostics by the numbers doesn't work, it is a must that a logical diagnostic process be followed.

How often does a car come to your bay with an automatic transmission shifting complaint that is not a transmission problem at all? Thinking back over the years, the analysis for auto-

BY ALBIN MOORE | CONTRIBUTING EDITOR

matic transmission shifting problems has changed a lot since the advent of the computer controlled automatic transmission. Terms like powertrain control module, transmission control module or engine control module come to mind when I start to analyze an automatic transmission problem.

Whether the vehicle is using a powertrain control module to control both the engine and transmission or an engine control module that is networked with a transmission control module, the outcome is about the same — a computer system capable of operating the engine and automatic transmission in harmony with each other. In today's world of powerful fuel efficient vehicles, this can be quite a difficult task to have the best of all worlds all rolled up in one tidy bundle.

Without an engine operating as it was designed to operate, the transmission will not operate and shift smoothly at the correct time and give the powertrain

that seamless transition of power from start through cruise speed. Just recently I was called to a shop to analyze an automatic shifting problem on a diesel powered vehicle. I was told the transmission wouldn't shift out of second gear. There were even some diesel fuel injection pump codes stored, along with some codes stored in the automatic transmission module. This one ended up being a fuel delivery problem. All the while, the shop was working on the transmission in an attempt to fix the shifting problem. So, how does a technician go about telling the difference between a transmission shifting problem, or an engine power supply problem?

Many times these kinds of transmission problems can be analyzed by using a scan tool and checking for any information that has been stored in the modules. At the start of any diagnostic process, the technician should be on an information gathering quest. I always like to start with the engine module to



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see if there are any diagnostic trouble codes stored. If there are, I will make a note of them and move on. The next stop will be to take a peek into the transmission control module. If there is any information stored here, take some notes and start putting a plan together. Problem analysis always starts with gathering information from many sources, then that information is put together in a logical progression and a diagnostic direction is started.

#### Get a Problem to Come to You

The starting point of the problem analysis is to determine whether the transmission shifting problem lies with the engine or the transmission. Many years ago, I was told, "the art of problem analysis is to get the problem to come to you." To accomplish this task, I will start by using a scan tool and watching engine data. This data will include watching the loop status, engine coolant temperature, Long Term Fuel Trim (LTFT) and Short Term Fuel Trim (STFT), and oxygen sensor activity from both the front and rear oxygen sensors.



### With a new ECT sensor installed and the CKP properly adjusted, the engine is running in closed loop.

The vehicle will be test driven on a route where the vehicle can be accelerated from a slow speed to 60 mph at full throttle, then driven at a steady cruise for about a quarter mile. By driving the



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vehicle in these conditions, the technician can get a feel for and capture data for engine operation in most any driving condition. The technician can also get a feel for the transmission shifting points and get a good seat of the pants feel for the powertrain operation and with the captured engine data a determination can be made for the next step in the analysis procedure. Keep in mind, if the engine does not operate properly, the automatic transmission will not perform properly, so the engine operation is always the starting point.

To help explain this analysis process a little easier, there is a 1999 Chevrolet K1500 Suburban sitting out in the parking lot. The vehicle is powered with the trusty 5.7 Vin R small block engine, has the power running through a 4L60 automatic transmission and is showing 188,000 miles on the odometer. The transmission was rebuilt about 12,000 miles ago. The vehicle owner had taken the vehicle back to the transmission shop to have a transmission shifting complaint analyzed. The transmission shop did all they could do and determined the transmission did not shift properly into fourth gear and the torque converter clutch would not lock.

I went out to the vehicle with the ignition keys, a scan tool and a note pad. The scan tool was used to access any diagnostic trouble codes stored, and the only code I found stored was

a DTC P1345 (CMP/CKP correlation). With the engine running, I noticed the idle was not smooth and the distributor offset data showed a value of -25 degrees. Engine data was captured for about seven minutes with the engine operated at several different engine speeds. The scan tool data shows the engine did not go into closed loop.

Looking at the engine coolant temperature data found one reason for the open loop condition — the engine coolant temperature was reporting around 60 degrees engine coolant temperature. Closed loop strategy on this vehicle needs to see the engine coolant temperature somewhere above 130 degrees for closed loop operation. Without closed loop operation, the torque converter clutch will not go to its lockup state. Hey, this is getting easy, but wait, I think a little more testing needs to be done before the vehicle is brought into the shop.

The vehicle was taken on the highway for a quick test drive to monitor the misfire data. The engine ran a little rough and the transmission would not shift into fourth gear unless the vehicle was on level ground or going down a slight downgrade. Capturing misfire data turned out to be a waste of time, since an engine running in open loop does not run its misfire diagnostics very well.

There is another way to find out what is causing the misfires. I could get out the ignition scope and hook up to the secondary ignition system and spend some time there, but with the distributor offset of -25 degrees, I first need to start with setting the distributor to its proper adjustment of zero degrees offset. I also know the engine coolant temperature sensor is only reporting around 60 degrees engine temperature. A quick shot at the engine with an infrared temperature gun verified the engine was running about 180 degrees, which tells me there is either a misreporting engine coolant temperature sensor or a problem in the engine coolant temperature sensor circuit. A quick test with an ohm meter of the engine coolant temperature sensor verified the sensor was not reporting properly. A new engine coolant temperature sensor was installed and the vehicle test driven.

With a new engine coolant temperature sensor installed, the engine cool-



Data taken before any repairs were started. Some things I noticed are the coolant temperature is not accurate and the engine is running at operating temperature, but the ECT PID is showing 60°F. The engine is running in open loop which is caused by the ECT of 60°F. The oxygen sensor voltage on bank 1 is not correct, which is caused by the engine misfires. This is a direction for me to look for the misfires on cylinder bank 1. The fuel trim information is of no value, because the engine is in open loop.







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ant temperature data showed correct on the scan tool and the engine went to closed loop a few seconds after startup. The distributor was also removed and installed properly, and the distributor offset adjusted to zero degrees. Now its time to get on the road and see what the misfire counters will do. By watching the fuel trim data and misfire counters, the technician can do a pretty good job of determining the cause of the misfire and where the next step of the problem analysis will take them.

Out on the road, the scan tool misfire data shows a lot of misfires on cylinders two, five and seven, with most of the misfires on cylinder five. By watching the misfire data, I can rule



With the CMP/CKP in proper sync and the ECT reading properly the engine will run in closed loop. Now the misfire detection will work properly. The data shows there are misfires on cylinders 2, 5 and 7, with most of the misfires on cylinder 5.

- D	iagnostic Suite					- 2 🛛
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0	MISFIRE CYL 3	0	0 M	ISFIRE CYL 4	0	
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Digital data of the history and current misfires. At times, the history misfire information is very good, especially when the misfire is a random misfire and the engine is running good while it is in the shop under the care of the technician.







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©2014 Federal-Mogul Corporation. NASCAR is a registered trademark of NASCAR, Inc. MOOG and The Problem Solver are trademarks owned by Federal-Mogul Corporation, or one or more of its subsidiaries, in one or more countries. All other trademarks are the property of their respective owners. All rights reserved. out a few things. Because the misfires are on both engine banks and misfires happen at all engine speeds and loads, an exhaust restriction on one cylinder bank can be ruled out. Some of the misfiring cylinders will misfire only with the engine under load. This directs me to a secondary ignition problem.

In a case like this, a quick way to get the problem to come to you is to fire up an aqua scope (spray bottle of soapy water) and give the secondary ignition wires and distributor a quick bath. This quick test found two ignition wires lying close enough to the exhaust manifold to have some charred insulation. With a new set of ignition wires installed, the engine runs nice and smooth. Now that the misfires are gone and the engine runs in closed loop, the vehicle can be road tested to see if the repairs to the engine have fixed the transmission shifting complaint, or to see if a real transmission problem will pop up.

Even at full throttle, the engine ran smoothly, with no misfires logged on the scan tool.

Why should the technician take the time to use a scan tool to verify a fixed problem, instead just taking a



Engine data after the vehicle was fixed. The things I watched closely are engine coolant temp, TCC lockup and loop status. On the test drive, I can feel the TCC lock and the scan data shows it happening.



Transmission shift data also is a very good thing to use in cases like this. Because the vehicle came in for a transmission shifting complaint, a quick test drive while gathering transmission shift data can be of great value. In the case of this data, it is easy to see the transmission is shifting properly and the torque converter clutch is working correctly and not slipping.

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test drive and using the seat of your pants to verify the fix? How many times have you seen misfire codes on a vehicle and you can't feel any misfire? We all know that a misfire is easier to feel on a four-cylinder engine than on a V8 or a V10, but just because you can't feel the misfires doesn't

mean the scanner can't. We all know of cases where misfires were being logged and there were no misfires, and in a case like this there is a chance the powertrain control module will not allow the transmission to shift properly. I call this being thorough in your testing. After all, this is what we as technicians get paid for — fixing the cars right the first time.

In this case, the misfire problem was fixed with a set of new spark plug wires and by setting the distributor to its correct position. The engine coolant temperature sensor has fixed the engine temperature problem, so the engine is now running in closed loop. With these conditions met, the transmission now shifts properly and by using the scan tool to log both the engine data and the transmission data, I can verify this problem is fixed.

The scan data shows the transmission shifting nice and crisp, the torque converter clutch locking nice and smooth and the torque converter clutch not slipping when the engine is put under load. By using both the seat of the pants and the scan tool to verify the repair, I know this vehicle will not be back with this transmission shifting complaint.



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

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Parts d TIPS

# FORD 6F50 AND GM 6T70: SIMILAR BUT DIFFERENT

THERE ARE PIECES OF THESE TRANSAXLES THAT MAY MAKE YOU ASK, 'HAVEN'T I SEEN THAT ELSEWHERE?' OTHER PARTS WILL BE NEW TO YOU.

he 6F50 and 6T70 transaxles were developed as a joint effort between Ford and General Motors. Because this was a joint effort, as you can imagine, many of the internal parts are very similar or almost identical but will not interchange. The solenoid body for example contains the TCM with GM's 6T70 (Figure 1) whereas Ford does not (Figure 2). The solenoids are controlled by an external PCM.

Ford uses a total of seven solenoids to operate the transmission (Figure 3), while GM's Generation 1 6T70 uses four pressure switches and eight sole-

### BY JOE CANGELOSI | CONTRIBUTOR

noids to operate their transmission (Figure 4). It also numbers its solenoids differently, but I labeled them according to their operation for ease of identification.

Both GM and Ford use the same firing order of the solenoids. The extra solenoid (SS2), GM uses for a reverse engagement. Ford handles it differently, eliminating the need for this additional solenoid. With having an external PCM, monitoring solenoid computer commands or solenoid resistance checks can be made at the pass through connector (Figure 5). The near closeness of the valve bodies between the two transmissions make them similar but they are totally different.

I am going to start at the top and work down from the solenoid body. Once you remove the solenoid body, the first thing you come to is the Upper Plate Assembly (Figure 6). The plate shown is for a 6T70. The difference here is the 6F50 does not have the aluminum block and the two feed holes circled. The aluminum block is used as a spacer behind the internal TCM and the holes are for the additional solenoid

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The next piece we come to is the Channel Plate (Figures 7 and 8). First look at Figure 7. This is the top side of the channel plate. The area circled in the worm tracks is where the passages are different for the additional solenoid on the 6T70. Also notice that there is the Ford or Hydra-matic Logo on the casting depending on the manufac-









turer. Now look at Figure 8. This is the bottom side of the channel plate. Here you'll find there are three solenoid feed accumulators that are only used on the 6T70. The 6F50 channeling is the same but it is not machined for the accumulator pistons.

Moving down, the next piece we come to is the Upper Valve Body (See Figures 9 and 10). For the most part,



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this section is identical between the two manufacturers. If you look at Figure 9, you'll see the valve lineups out of their bores. They are both the same for the 6F50 and 6T70. Figure 10 shows the difference in check ball usage between the two units. Ford uses two less then GM however the Ford casting is machined for the additional check balls.

The last piece we are going to look at is the Lower Valve Body (Figures 11 and 12). Here the only difference is the 4-5-6 accumulator used on the 6T70. All of the other valve line ups are the

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same for both units.

A quick word about the upper and lower separator plates on these valve bodies. They both use bonded gaskets and because of the different check ball and solenoid feed accumulator usage on the 6T70 they are both different.

To sum up, over the years there have been some minor changes to the valves and springs on both the 6F50 and 6T70 but in the end you'll find they are both similar but different.  $\overline{\mathbf{Z}}$ 



Joe is a 45-year veteran of the automotive repair industry wth more than 30 years of that spent as a transmission specialist. He has experience as a technician, technical consultant, writer, trainer and presenter. Semi-retired, he stays busy doing product support work for Valve Body Xpress.

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### TECHNOLOGY THE NUTS AND BOLTS OF AUTOMOTIVE REPAIR

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# **MASTERING** FUEL INJECTION

## REVIEW THESE DIAGNOSTIC TECHNIQUES THAT WILL LEAD YOU TO THE ROOT CAUSE QUICKLY.

BY **BERNIE THOMPSON** | CONTRIBUTING EDITOR

ince the introduction of fuel injection on the internal combustion engine (ICE) more than 100 years ago, there have been many changes to this system. Early fuel injection systems were based on mechanical principles, and used a jerk pump that metered high pressure fuel to a mechanical injector. Later came electronic fuel injection systems that work with both mechanical and electronic principles; these systems use a microprocessor that calculates the fuel delivery needed and commands the fuel injector solenoid. With either of these systems the end result is to meter the correct amount of fuel and deliver this in an atomized format to the cylinder. This is better accomplished with the modern electronic fuel control system, so this is the system used on the vast majority of newer vehicles.

These modern electronic controlled engines are high tech marvels that have more computer processing power than the space shuttle. With this type of sophistication present within the vehicle, many shops struggle when it comes to repair-

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ing the modern fuel injection system. When diagnosing electronic engine control systems, 80 percent of these types of problem are moderately easy, 13 percent of these types of problems are difficult, 5 percent of these types of problems are extremely difficult and 2 percent of these types of problem might be unable to be diagnosed by the shop. Many shops are losing all of their profits from the 80 percent that are easy by trying to fix the 20 percent that are hard. What we need are techniques to diagnose these sophisticated vehicles quickly and accurately, and do so in a way that allows the shop to make money.

#### **More Than Just Fuel**

Diagnosing drivability problems can, and should, be very profitable. In order to diagnose fuel injection problems fast and accurately, you must think outside the box. Fuel injection is about the fuel. right? The fuel is pressurized and delivered in a controlled manner to the cylinder. Fuel injection is part of the engine control system. This system will regulate the intake air, fuel and spark timing in order to achieve the desired performance in the form of torque or power output. The driver of the vehicle will determine the power output from the engine by pressing the accelerator pedal. This is a request to the microprocessor from the Throttle Position Sensor (TPS) or from the Accelerator Pedal Position Sensor (APPS). These sensors convey the driver intent in the form of voltage.

As with all sensors, the TPS and APPS take a physical quantity and convert this quantity to an electrical output signal (voltage). The microprocessor then uses a circuit to change the sensor voltage into a binary code (1s and 0s). This binary code allows the microprocessor to read the voltage change produced from the sensor. In order for the microprocessor to use this voltage, a programmer will program a look up table, otherwise known as a transfer function table. This transfer function table takes the voltage and converts it

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to a physical quantity. One example of a transfer function table would be used for a Mass Air Flow (MAF) sensor. This sensor may produce an analog voltage that will need to be converted into air weight (grams per second). The transfer function table will have all of the voltage readings that can be produced from the MAF sensor on a particular engine, and will provide an actual air weight for each of the voltage readings. In this way the voltage can be used to represent the actual air weight.

So what is the fuel injection system doing as the engine is running? It is calculating the amount of air entering the engine and commanding the fuel injector on-time, the fuel injector sequence, the ignition spark timing and the ignition spark sequence, as well as other functions. We think of fuel injection as being about the fuel; however fuel injection is about the air. You must think outside the box because before the microprocessor can do any control function, it must first calculate the air weight entering the engine.

The fuel weight is a known factor; the air weight is the unknown factor. The fuel injector flow rate is known and is rated based on the restriction size of the discharge orifice and the fuel system pressure. This orifice size is rated by what is known as the Injector Slope or the Injector Flow Rate. This flow rate is the weight of fuel the injector can deliver in a set amount of time. As seen in Figure 1, the fuel weight delivered in a set amount of time can be calculated.

The air flow into the engine is an unknown factor and must be calculated. This air weight calculation can be made using different methods; the two most common methods are Speed Density and Mass Air Flow. Both Speed Density and Mass Air Flow calculations will provide the actual Air Weight entering the engine. This air weight can be displayed in Grams Per Second (GPS). However, these Air Weight calculations are derived differently. Speed Density measures the vacuum in the manifold to calculate the air weight. This is an indirect or inferred method that uses look up tables based on engine vacuum (engine load) and the engine rotational speed (rpm).

Mass Air Flow is a method of measuring the air weight directly. With this method, the direct voltage produced from the MAF sensor is used in conjunction with the transfer func-



Figure 2

EXAMPLE for 8 cylinder at "hills" Total air flow = 5 Grams Per Second 800 RPM / 60 seconds = 13.33 Revolutions Per Seconds 13.33 RPS / 4 intake strokes on 8 cylinder = 3.33 ISPS 5 GPS / 3.33 Intake Strokes Per Second = 1.50 GPC 1.50 GPC / 14.7 Air Fuel Ratio = .102 Fuel Rate .102 FR / (injector) .0483cc per ms = 2.11ms 2.11ms Injector Turn On Time = 3.11ms 3.11ms Injector On Time EXAMPLE for 8 cylinder at "WOOT" Total air flow = 240 Grams Per Second 6000 RPM / 60 seconds = 100.0 Revolutions Per Seconds 100.0 RPS / 4 intake strokes on 8 cylinder = 25.0 ISPS 240 GPS / 25.0 Intake Strokes Per Second = 9.60 GPC 9.60 Grams of air Per Cylinder 9.60 GPC / 13.0 Air Fuel Ratio = .738 Fuel Rate .738 FR / (Injector) .0483cc per ms = 15.27ms 15.27ms + 1ms ITOT = 16.27ms 16.27ms Injector On Time tion table. Once the total air entering the engine has been weighed, the air flow entering each cylinder must be calculated, as seen in Figure 2. It is important to understand that the total air entering the engine must be converted into the amount of air entering each of the cylinders. Once the air in the cylinder is known, the fuel weight to the cylinder can be delivered.

#### **Volumetric Efficiency**

Because the Engine Control Module (ECM) is calculating the air rate entering the engine in order to deliver fuel, the AIR is very important. For a quick and accurate diagnosis, it will be necessary to calculate the AIR rate into the engine. This is known as Volumetric Efficiency (VE), or the ability of the engine to pump air. The air entering the engine can be calculated with a basic mathematical equation. If the liter size is known, the barometric pressure is known, the engine rpm is known and the air temperature is known, an equation can be given for the air entering the engine

So what Volumetric Efficiency would the engine that you are working on have? Volumetric Efficiency is the engine swept volume (displacement per cylinder) x the number of cylinders x rpm / intake strokes per revolution = 100 percent VE. However, other factors come into play. Air density, barometric pressure, and engine design can impact the air flow into the engine. Most naturally aspirated engines have a Volumetric Efficiency of about 86 to 89 percent at sea level. Some high performance engines have a Volumetric Efficiency of about 93 to 99 percent at sea level. Because the Volumetric Efficiency is not truly an efficiency, the engine can have a VE greater than 100 percent.

How do you use VE to fix your vehicles? By calculating the VE of the engine and comparing it to the actual Mass Air Flow sensor reading, you can determine whether the airflow to the engine is correct. Take your scan tool and set it up to make a recording. Drive the vehicle from a stop in first gear and accelerate under Wide Open Throttle (WOT). Once the vehicle has pulled through first gear, take the recorded data, calculate the VE (there are a number of manual VE calculators available on line) and compare the calculated VE against the actual MAF grams per second.

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The Escan scan tool by ATS automatically does this VE calculation for you as seen in Figure 3. The yellow trace is the actual MAF sensor reading in Grams Per Second and the red trace is the calculated VE. When these graphs are overlaid it is quite easy to see any differences. The table to the right shows the percentage difference between the actual MAF and the calculated VE.

The ECM is weighing the air and then controlling the fuel delivery (fuel weight) into the engine. This is a feed forward system. With a feed forward system there is no way to correct it if anything is wrong. What is needed is a way to change the base air equation so the fuel delivery can be modified. This will allow the fuel weight to match the air weight keeping it stoichiometric for a complete reaction. This is accomplished by the use of an oxygen sensor or Wide Range Air Fuel sensor.

The ECM then uses this data to make changes to the fuel injector on-time. The ECM calculates the air weight and then delivers the fuel weight (this is feed forward). The oxygen sensor then weighs the air/fuel ratio and sends this data to the ECM where it is used to change the air/fuel ratio (this is feedback). The fuel trim is the control of the feedback system. If anything is incorrect with the feed forward system, the fuel trim will modify the base air equation so that the fuel weight to air weight can be corrected.

The air weight calculation is made, the fuel weight is delivered, the oxygen sensor weighs the air/fuel that was delivered, the ECM calculates if the fuel delivery needs to be changed and uses a modifier in percent called fuel trim

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in order to change the air/fuel weight. Now that this sequence is understood it will be easy to see that the VE will be used in conjunction with the fuel trim to diagnose the fuel injection system. If either the VE or the fuel trim is used separately, this data will not provide you with the information required to diagnose the system. However, when VE and fuel trim are used together it becomes magic.

#### **Real Cases**

Now that we have the winning formula let us diagnose a few problem vehicles. The first is a 2003 KIA Sorento. This KIA was driven while the scan tool recorded the data. In Figure 4, the calculated VE is shown in red and the actual MAF air weight is shown in yellow. It is clear

that these two traces do not follow each other. The calculated VE is 37 percent higher than the actual MAF air weight. With only the VE data you would not be able to determine what the problem is, but only that the engine's pumping ability is low (restricted exhaust, restricted induction, camshaft timing, etc.) or the MAF sensor is reading incorrectly (air leak, bad MAF or circuit, transfer function table).

In Figure 5, the total fuel trim (long term plus short term) is shown. It is clear that the ECM is adding a lot of positive fuel trim at +36 percent. With only the fuel trim data, you would be unable to determine what the problem

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is. This data only indicates that the system is adding a large amount of fuel. This could be caused by low fuel pressure, bad oxygen sensor, bad MAF sensor, etc.

Now let the magic begin! We will compare the VE and fuel trims together. First we will analyze the VE chart. This chart shows that the VE at 2,100 rpm is 25 percent different and at 4,500 rpm is 37 percent different. Now let us

analyze the fuel trim chart. At 2,100 rpm the fuel trim is +24 percent and at 4,500 rpm the fuel trim is +36 percent. It now becomes clear that the air weight was misread by the MAF sensor and the fuel was delivered for this incorrect air weight (feed forward). The oxygen sensor then read the incorrect air/fuel weight and the ECM corrected the low

air weight reading with the fuel trims (feedback).

It is important to note the air rate difference provided with the VE matches the positive fuel trim numbers, this shows that the MAF sensor is misreading the air weight. The reason that the air weight matches the fuel trim is that the fuel trim is a multiplier to the base equation. In other words, the base equation is based mainly on the air weight so when the fuel trim is used as a multiplier it is increasing or decreasing the air weight. Yes, the fuel trim is about the air weight. As the air weight is changed the fuel weight will be changed to match the air weight, thus keeping the air/fuel



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ratio at stoichiometric. On this 2003 KIA Sorento, the MAF sensor is bad. Before any sensor is replaced, always test the circuit. It takes a good power and ground to make sensors function correctly.

The second problem vehicle is a 2005 Subaru Forester. First we will analyze the V.E. as seen in Figure 6. The calculated VE (red trace) and the actual MAF air weight (yellow trace) follow each other quite closely; this indicates that the air weight was read correctly. Now we will analyze the total fuel trim chart as seen in Figure 7. By analyzing the fuel trim chart, it is clear that at low engine loads there is no problem present. However, as the engine load is increased the fuel trims are indicating problems. By looking at the VE chart, it is clear that this problem is in the fuel delivery side of the system. By using both the VE and fuel trim you can divide the system into the air side and the fuel side. Since the air was read correctly the problem is on the fuel side. Now it is necessary to look at how the fuel trim changes occur under the dynamic load of the engine.

When diagnosing fuel trim problems, never look at the fuel trim in only



one load state. It will be important to run the engine through its entire load range and analyze how these fuel trims change. On this Subaru, the fuel trims are good at low engine load, low fuel consumption conditions. As the engine load is slightly increased the fuel trims become negative (taking away fuel). Then, as the engine load is further increased the fuel trims become positive (adding fuel) under high fuel consumption conditions. Under load these fuel trims are adding up to +38 percent, which is a large fuel trim correction.

So what is this chart showing us? It is indicating that the fuel delivery cannot keep up with the fuel needed to produce power under load. But what about the negative fuel trims? Since these negative fuel trims are right at the point the fuel pressure is failing, the fuel pressure at this load point is both good and bad. The negative fuel trims at this load point are caused as the fuel pressure drops and then returns back to high pressure.

As the engine load is increased, the fuel pressure continues to drop, thus the fuel trim is increased to compensate for the lower fuel pressure. On this Subaru Forester, a restricted fuel line is the cause of this problem. In order to find this type of problem an amp clamp on the fuel pump is used with an oscilloscope. This will provide the fuel pumps current draw and rpm.

The VE and fuel trim technique is just magical and it is important to just use this technique regardless of what scan tool you have. The more you become familiar with this technique, the faster your diagnostic routine will become. Soon you will be able to diagnose problem vehicles on your initial test drive. ZZ



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

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# TECHNOLOGY



AGM batteries are coming as standard equipment on high tech vehicles such as this Toyota Prius.

### THE PROPER CARE AND SERVICING OF Absorbed glass mat batteries.

BY DAVE MACHOLZ | CONTRIBUTING EDITOR

ooks can be deceiving. Just because something looks like a technology we are used to seeing doesn't necessarily mean that we can test it and service it the same way we always have. Case in point: AGM batteries. AGM batteries, a battery technology in the valve regulated lead acid (VRLA) family, often look identical to their flooded lead acid (FLA) counterparts. Battery manufacturer's such as Johnson Controls, are revving up their production of AGM batteries to suit the needs of today's high tech vehicles and are producing millions of AGM batteries annually. This is a sure sign that you will be seeing these batteries in more applications in the near future. In this article we look at what makes these batteries different from traditional lead acid batteries and, most importantly, how to test and service them.

Absorbed glass mat (AGM) batteries are nearly identical in appearance and chemistry to flooded lead acid batteries. Flooded lead acid batteries are the batteries we all grew up with and are familiar with servicing. If you need to brush up on your battery chemistry knowledge, take a look at my blog in the Motor Age AutoPro Workshop at workshop.search-autoparts.com. The internal difference between AGM batteries and their FLA counterparts is a fibrous glass mat material separator that acts as a sponge for the electrolyte around the plates which provides electrolyte coverage to a greater surface area of the plates. This "absorption" of electrolyte allows for more efficient use of the plate surface area.

The result of this efficiency is a smaller, lighter, more effective battery. In most AGM designs, the mat is wrapped around the positive plate that protects the plate from vibration and extended cycling. For this reason alone, battery manufacturers claim that AGM batteries have double the overall cycle life of the traditional FLA battery. The AGM cells are housed in a sealed, maintenance free, spill proof housing with a one way pressure relief valve.

AGM battery manufacturers use what is known as "recombinant" technology that takes the oxygen produced on the positive plate and combines it with hydrogen to produce water (H<sub>2</sub>O). For this reason, AGM batteries are self-watering and do not typically vent hydrogen, making them a great candidate for placement inside the vehicle or wherever the engineer may want to place it for weight distribution purposes. Note: The battery cannot be placed in a sealed compartment in the event that the battery outgasses hydrogen through the one way relief valve due to overcharging.

Let's summarize the advantages of AGM Batteries:

• The AGM battery can be made smaller and lighter than a flooded lead acid battery while maintaining or even increasing the battery capacity and cold cranking amperage comparatively.

• The AGM battery is spill proof allowing for mounting in a variety of locations and positions.

• AGM batteries are shock and vibration resistant.

• AGM batteries boast a service life that is nearly double that of traditional FLA batteries.

• AGM batteries are maintenance free.

With every new technology there is a downside. I like to think of this as more of a learning curve. Once you know the ins and outs of this technology, you can proceed with

confidence. Let me share just one example. Several years ago a student approached me after class to ask me about a problem that he had encountered with his Optima AGM battery. He



AGM batteries look identical to their flooded lead acid counterparts.



The Midtronics GR8 is the required battery charger for many manufacturers because of its "smart charging" strategies and fool proof operation.

Photos: (TOP) Exide; (BOTTOM) Dave Macholz

Looking for the source of parasitic drain? This edition of The Trainer has ideas on where you can locate it. MotorAge.com/ draintrainer

had purchased the battery for his off-road vehicle that was driven only on occasion. The vehicle was used so infrequently that each time he went to start it, it needed to be jumped. (I would imagine he also had several parasitic draws on this vehicle with his

addition of numerous aftermarket accessories.) On one occasion, he decided to charge the battery before attempting to start the vehicle and his problem got worse. He said "How is it that this ridiculously expensive battery is such a piece of junk!"

His problem might be one that you have encountered in your shop in that AGM batteries require a very specific charging strategy. Because AGM batteries use the process of recombination, the charging rate has to be limited. Using just any old battery charger typically will result in a phenomenon known as thermal runaway. What happens here is the excessive voltage / amperage charging rate increases the temperature of the plates and results in a production of excessive hydrogen that cannot be recombined. The result of thermal runaway is an outgassing of hydrogen. Remember the one way pressure relief valve? It is installed specifically for this situation.

The problem is, it's irreversible. With the outgassing comes a loss of electrolyte rendering the battery a useless paperweight in most cases. Without electrolyte there is no chemical reaction to produce a voltage potential difference between the positive and negative plates. No amount of recharging can solve this type of problem. My student learned a costly lesson and got an education on AGM battery charging.

#### **Getting it Right**

So how do you know what charging voltage / amperage is acceptable? That is a tricky question. If you ask Toyota how to charge the 12-volt AGM batteries in their Prius, Highlander or Camry hybrids, they will give you three different answers. Basically, it





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depends. Remember Ohm's law. Voltage and amperage are proportional if resistance remains the same. The higher the voltage your charger puts out the more amperage it puts out as well. Do you know how much voltage your charger delivers when charging? How about how much amperage it delivers? If not, you need to find out.

On some of the Toyota products the recommended charging amperage is 5 amps, an extremely low rate of charge. You need to be certain of the capability of your shop's battery charger to charge these AGM batteries. Toyota and many manufacturers have gone to a smart charger such as the Midtronics GR-8 that implements a charging strategy based on the battery's capacity, CCA rating and state of charge. This smart charger monitors battery temperature and condition during the process as well.

The beauty of this charger is that it removes the guess work. This may seem to be overkill, but after you replace a few of these toasted AGM batteries you may see the light. AGM charging and incorrect charging system strategies are the leading killer of AGM batteries. If you are uncertain of whether a battery is an FLA or an AGM, it is important to consult the repair manual to make a determination of the battery type you are dealing with and its recommended charging rate. Many shops I train are switching to smart charging for every vehicle which helps reduce costly oversights by their technicians. There are many chargers on the market that are up to the challenge. Snap-On, for example, makes a charger that is very close in operation to the Midtronics GR-8.



are readily available.

Some manufacturers initially had issues implementing AGM charging strategies and one that comes to mind is the Toyota Prius. It seems that every one of these vehicles I see for what was thought to be a major hybrid system problem was in fact a bad AGM 12 Volt battery. For the most part most these issues are a thing of the past. Some manufacturers such as BMW have taken charging system strategies to new levels. Have you replaced a battery in a





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BMW uses a charging strategy that varies based on the service life of the battery. In plain terms it has a different strategy for new batteries and changes that strategy as the battery ages. This registration procedure requires the use of a scan tool, and





Autologic's BMW scan tool allows you to replace an AGM battery with a standard FLA and will reprogram the vehicle's charging system accordingly.

you will need to determine if your scan tool can perform this function.

Autologic's BMW tool platform is one example that is up to the task. In fact, its tool will allow you to substitute a standard FLA battery and program the computer to charge it accordingly. Companies such as Snap-On and OTC are joining the European party as well, but do your homework before you commit. If you are unfamiliar with coding and programming on European vehicles you may want to consider a platform such as Autologic as they offer an industry leading customer service and tech support by BMW master technicians to help you through these types of procedures.

When it comes to AGM battery testing, you will be relieved to know that you can test these batteries in the same manner as you would test a traditional FLA battery with the exception of a specific gravity test. A load test or conductance test is perfectly acceptable. Remember that any



When registering the battery on a BMW, Autologic's tool will prompt you to enter the vehicle mileage in order for the computer to implement the correct charging strategy.



testing you choose to use is not foolproof, as there are infinite variables that contribute to a battey's state of health but your tried and true method of testing should give you a good indication of the ability of the battery to do its job. Many of the contributors at Motor Age have visited the subject of battery testing that are very much applicable to AGM technology. Be sure to have a look in the searchautoparts. com archives for some more extensive battery testing information including some great videos and articles.

To summarize AGM battery diagnosis and testing remember the following points:

• Determine if the battery you are working on is an AGM of FLA battery. Remember, they may look identical.

• Do not attempt to add water or open the case of an AGM battery.

Do use your preferred battery testing method including load testing and or conductance testing.

Be sure to use a battery charger intended for AGM batteries.

If you don't have access to an AGM battery charger, be sure that the charger you're using will deliver the proper voltage/amperage required by the manufacturer.

 Before changing an AGM battery in a vehicle such as a BMW, be certain that you have the capability to register the battery with your scan tool.

With a little knowledge and confidence, testing and servicing AGM batteries is well within your capabilities. There is a wealth of information within your reach at searchautoparts. com to supplement your knowledge of battery testing and service. The more informed you are the better prepared you are to serve your customers, so read up! 🌃



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

**≢=**<sup>7</sup> E-mail Dave at liautotraining@gmail.com

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Figure 1

TECHNOLOGY



# BOOSTING ECOBOOST SERVICE

# WHILE IT WAS BIG NEWS AT FIRST, SERVICING THE ECOBOOST ENGINE MIGHT BE COMMON IN YOUR SHOP.

BY **DONNY SEYFER** | CONTRIBUTING EDITOR

n May 2009, Ford began mass-producing an engine that has changed every vehicle it finds its way into. With the introduction of the EcoBoost engine family and its ability to deliver horsepower and torque normally reserved for the largest displacement naturally aspirated engines, a V6 F150 with a trailer behind it or a 3 cylinder "hot hatch" now seems perfectly natural. The original offering was the 3.5L V6 finding its way into the F150, Taurus SHO/Lincoln MKS and the Ford Flex/Lincoln MKT vehicles. By utilizing a pair of small and speedy turbos on a dual overhead cam engine with direct injection and variable valve timing for each cam, 365 hp came pretty easily and, as time has shown, reliably too. Not to take anything from the 3.5L GTDI engine; 100 hp and 100

foot-pounds of torque per liter is certainly rarified air for any performance engine. We also have to keep in mind that the 3.5L gives moms the kind of power to weight ratio in a seven-seater that most of us have come to expect from a two-seat sports car.

Yes, those numbers are good, but Ford has another EcoBoost in the stable that produces 125 hp per liter and 148 foot-pounds. If we were talking about

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#### Starting at the Bottom

From the foundation out, let's talk about the block. The 1.0L EcoBoost is the only engine in the line that has a cast iron cylinder block. Ford's engineers went this way for two reasons. The first is strength. The latter is the theme of the entire 1.0L project and that is thermal efficiency. Ford says this engine warms up 50 percent faster with the iron block. The block has substantial support webs that tie the main caps to the oil pan rails. Inside the block there are piston oil squirters to maintain consistent piston temperatures.

The rear main seal retainer is moved to the back of the block to allow the rear main cap to have more rigidity.

Have you seen

the Ford Atlas concept

truck? Pete Meier shared

MotorAge.com/

fordatlas

To round out the rest of the bottom end, you probably will notice that this engine does not have a balance shaft. Ford decided that they rob too much power, and a video look at the vehicle. instead appied a special misbalance to the flywheel to make this engine run smoothly. The connecting rods are the powdered metal variety

Ford has been using for many years. EcoBoost engines get a slight different metallurgy to make their rods stronger. The pistons are special in all EcoBoost engines to accommodate the direct injection nozzle mounted over the top of them. In Figure 4 you can compare the 3.5L direct injection piston on the right to the conventional DOHC 3.5L on the left. This is typical of EcoBoost piston design and yields

a 10.0:1 compression ratio but runs on regular fuel.

Bolted to the bottom of the block is a large oil pump reminiscent of a race car's external oil pump. The oil pan is a wet sump design but the oil pump is driven by a special Gilmer

Drive belt that is submerged in oil as is the engine's timing belt. Rubber timing belts offer quiet operation, but cause frictional losses. Timing chains in applications like this cause frictional losses through the necessary timing chain quides. This belt design has been in use in commercial

applications, and Ford is confident that with reasonable and correct oil maintenance these belts are reliable for 150.000 miles.

Moving to the top of the engine we find an aluminum head with dual cams each equipped with a variable cam timing phaser electronically controlled by the Powertrain Control Module (PCM) to advance and retard the cams to create different power band adjustments



Ford celebrates the 2 millionth EcoBoost engine coming off the line.

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as needed. Because of the ability to let cool air pass through the engine or leave a slittle exhaust behind as required, this engine does not have any exhaust gas recirculation. The valves each have a cup over the top, which will be familiar to those with experience in VW/Audi to allow shimming of valve to cam clearance. This appears to be like others using this design; adjustment will be needed at high mileage only.

Ford uses a returnless lift pump that feeds low-pressure (about 65 psi) fuel to the high-pressure mechanical pump that runs off of the cam. It generates up to about 2,150 PSI. To ensure quick starts and adequate fuel to the highpressure pump, the Fuel Pump Control Module (FPCM) is triggered by the Body Control Module (BCM) when the interior lights come on. This will prime the system prior to start. Ford has also replaced the inertia switch with a signal generated by the Restraints







Control Module (RCM) to inform the FPCM that an accident has occurred. This will turn off the low-pressure side of the system. Because most of these vehicles are push-button start, cycling the button on and off or the key on and off and back on will reset the system.

The engine management system departs from standard Ford significantly. It is wise to consider this a whole new system. To assist with self-diagnosis, the management system has several pressure and temperature sensors. A Mass Air Flow (MAF) Sensor is not used. This is Speed Density with several twists. Like the MAF system, this management system is trying to determine the amount of air that runs through the engine along with its pressure and temperature all through the intake tract.

Unlike most engine management systems, this one does not need to guess at how much fuel is being delivered. The system knows how much fuel volume the high-pressure pump can deliver and actually regulates and monitors the pump output. To assist in tuning fuel delivery, the PCM has a wide band oxygen sensor with new scan tool Parameter Identifiers (PIDs) that will display lambda and air fuel ratio. A visit to motorcraftservice. com for the free 262-page OBDII 2014 model information will give you more detail on the engine management system changes.

One of the biggest losses of heat energy is the exhaust. This is why turbo chargers have made so much sense for small engines. Ford engineers have come up with a clever way to capture a good deal of this lost exhaust heat and use it to warm the engine quickly. The cylinder head has an integrated exhaust manifold that has coolant circulating around it. The turbo simply bolts on a neck on the side of the head. To utilize this heat, the 1.OL EcoBoost has three cooling system circuits and two thermostats. As the engine starts up, warm up Phase 1 begins with the mini-cooling system. Coolant is circulated by the mechanical water pump around the exhaust manifold side of the head, into the heater core, oil cooler and through the turbocharger by way of an auxiliary electric pump.

The main thermostat allows bypass when engine speed exceeds 3,000 rpm to avoid excess pressure. The block thermostat begins opening at 158 degrees. When it reaches 185 degrees, Phase 2 begins. In this mode, the small cooling system works much like conventional cooling system bypass systems circulating coolant throughout the engine and heater bypassing the radiator until the engine reaches 222 degrees and the main thermostat opens bringing the entire cooling system online.

To assist in managing temperatures, the Fiesta has PCM controlled radiator shutters. These engines warm up very quickly. I have timed an EcoBoost 2.0L at 1 minute 40 seconds to fully warmed up on a 40-degree morning from a cold start.

One final feature of the 1.0L cooling system is the electric auxiliary water pump that is used to circulate coolant to the turbo charger at certain times. It is used as an after shutdown cooling system when the engine has experienced high loads and a quick shutdown. The PCM has DTCs related to its monitor for the thermostat. With this tight control on temperature it can catch a thermostat that is performing below spec based upon time and temperature. The PCM also calibrates the radiator shutters at each start up by opening and closing them fully.

This small but mighty engine has taken advantage of seemingly every possible means to save and reuse heat energy. Its light-weight and high efficiency give the Fiesta great handling and near hybrid gas mileage. Some serious forward thinking for a company who, only a few years ago, seemed to build small cars as a CAFE adjustment for pickup truck sales. The fun factor is high and the technology is impressive. **Z** 



Donny co-owns Seyfer Automotive, Inc. in Wheat Ridge, Colo., and is chair-elect of ASA. He is a regular contributor to ABRN and sister publication Aftermarket Business World.

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TECHNOLOGY

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# **ONCE BITTEN, TWICE SHY**

### WHY I HARP ON CHECKING MODE \$06 TO AVOID COMEBACKS.

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

he customer came in with a complaint that his Check Engine light was on. A quick scan easily showed the reason for the complaint; a P0401 (Exhaust Gas Recirculation (EGR) Insufficient Flow) code was found when I checked using Global OBDII's Mode \$03. Certainly by now, you know that I don't stop there. My next step was just a few cursor clicks away, checking for any listed test results in Mode \$07, more commonly thought of as pending codes stored. Sure enough, two Diagnostic Trouble Codes (DTCs) were found: a P0300 (Random Misfire) and P0308 (Cylinder 8 Misfire).

If the Engine Control Module (ECM) saw either one of those again (in succession), they would move over to hard code status and show up later in Mode \$03 and turn the Malfunction Indicator Lamp (MIL) back on. I made a note to share this information with the customer to make sure he knew there were other problems that may need attention soon, especially since they may or may not be corrected with the EGR flow fix the car was in for today.

If you understand OBDII testing strategy basics, then you know there was one more stop I needed to make before I was ready to tackle the P0401. Backing out of Mode \$07, I next went to Mode \$01. Here is where I would verify what onboard monitors (or system self tests) had been completed and which ones may still be pending completion.

Why is that important? Monitors often share systems or individual system components. When any code sets, related monitors may be temporarily suspended pending repair of the failed system or component.



There's a bit more to how monitors work and interact, more than we can tackle in this column, but do a little digging on the Motor Age website and you'll find plenty of help in understanding it all. For now, I'm looking for any monitors that are listed on my scan tool as Incomplete or Not Ready, indicating that testing for those monitors has been temporarily suspended or that the conditions they needed to complete have not yet been met. In either case, it is possible that they will find a problem and turn the MIL light back on after I send the car home. And unless I make my customer aware of that, I'm the one that's going to look bad!

Looking at the monitor status, I noticed that both the catalytic converter monitor and the evaporative emissions (EVAP) system monitors were Not Ready. I wasn't too concerned about the EVAP monitor; it can take a while to run, especially on an older vehicle like this Expedition. The cat monitor, however, was a bit more concerning. Misfire codes, for sure, will suspend this monitor on most all makes. To be safe, I took a snapshot of the screen information to share with the owner and to keep in my shop's records.

With the preliminaries out of the way. I turned my attention to the Freeze Frame data (do you know what mode that's in?) that was not very helpful on this DTC since it did not provide specific EGR flow information. As you can see in Figure 1, and reviewing the Freeze Frame data on this vehicle, there is nothing that stands out indicating an EGR issue. My next step was to check Mode \$06 data to see if there was any information that would help me confirm the DTC. Looking at the list in Figure 2, vou can see that this vehicle is not equipped with a Controller Area Network (CAN) protocol since it lacks a long data list. Ford has always been helpful with misfire information in their Mode \$06, even pre-CAN, and you can see that here as well.

Let's take a look at what else is on this list to see if any of the information will be useful in diagnosing and predicating what else may fail. The systems/monitors that Mode \$06 reports on are the  $O_2$  sensors, catalyst, EVAP, EGR and misfire. Now I can zone in on the EGR data looking at what test failed and by how much. The Mode \$06 test Test ID (TID) \$4A is the DPFE EGR system monitor. The Component ID (CID) \$30 is the EGR Flow Test that

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_			\$01: Front Oxygen Sensor Monitor			\$11: B1S1 Voltage Amplitude			0.665	0.502		volts		
LEAN LEAN		AN	\$01: Front Oxygen Sensor Monitor			\$21: B2S1 Voltage Amplitude				0.757	0.502		volts	
		2014	\$03: Front Oxygen Sensor Monitor			\$01: Upstream Switch Point Voltage			itage	0.452	0.000		volts	
		\$03: Rear Oxygen Sensor Monitor			\$02 Downstream Switch Point Voltage			0.502	0.000	-	volts			
CENTER CENTER		\$10: Catalyst Efficiency Monitor			\$21: Bank 2 Switch Ratio			0.733		0.749				
		\$10: Catalyst Efficiency Monitor			\$11: Bank 1 Switch Ratio			0.733		0.749				
		\$22: EVAP System 0.040 Leak Check		\$00: Vacuum Bleed-up Leak Check			-63.898		2.496	in H20				
ROBLEM PROBLEM		\$25: EVAP System 0.040 Leak Check		\$00: Vapor Generation Pressure Rise			-63.898	1.498		in H20				
		BLEM	\$45: DPFE EGR System Monitor			\$20: EGR Stuck Open Test			0.655		1.282	volts		
			\$4A: DPFE EGR System Monitor		\$30: EGR Flow Test				-0.616	5.990		in H20		
FUEL	FU	EL	\$4B: DPFE EGR System Monitor		\$30: EVR Duty Cycle Flow Test				89 941		79.953	96		
TRIM	TH	M	\$50: Misfire Monitor		\$00: Total Engine Misfire				0.000	1	2.457	%		
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		\$51: Misfir	\$51: Misfire Monitor Cylinder #7		\$07: Cylinder #7 Misfire Rate			0.000		2.457	%			
Engine Vacuum Vac (HO)		\$51: Misfir	\$51: Misfire Monitor Cylinder #8		\$98: Cylinder #8 Misfire Rate			0.000		2.457	96			
	_	NaN	\$52 Misfir	e Monitor		\$00: C	onsecutive	cyl. events du	uring test.	0.000		0.000	events	
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Monitors # not run Not Complete		# not run	Click on above row of interest to get Related DTC and explanation if available.											

is part of that monitor, and has a Test Value (result) of -0.616 and a Minimum Limit value of 5.990 (both in Units of in/H2O (inches of water)), failing by a very large margin. When you see such a big spread from the test value to the limit whether it is a minimum or maximum the system is not functioning at all. The EGR also failed for the EGR Duty Cycle Flow test, but passed the EGR Stuck Open Test eliminating the possibility that the EGR valve is sticking open.

### "With the information provide in Mode \$06, I now know exactly what I'm looking for in the EGR system and it's time to see why the EGR has no flow."

Other alarming information highlighted in yellow (close to failing) on this Mode \$06 list is the catalyst efficiency test, showing both banks are very close to failing. Remember that I had two monitors that were Not Ready," one of them being the catalyst monitor. This information is telling me that it is a very real possibility that a P0420 and/or P0430 (Catalyst Efficiency Below Threshold) DTC may crop up and illuminate the MIL. I also

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need to look at another problem on the list that you can see is failing (high-lighted in red). TID \$25 (EVAP System 0.040 Leak Check), CID \$00 (Vapor Generation Pressure Rise) has a Test Value of -63.898 and a Minimum Limit test value of 1.498, also in units of in/ $H_2O$ . Once again the monitor is "Not Ready" and there is another strong possibility of a DTC when this monitor completes its testing.

With the information provide in Mode \$06, I now know exactly what I'm looking for in the EGR system and it's time to see why the EGR has no flow. Usually no flow indicates that the EGR valve is either not opening up, the EGR passages are clogged or there is a sensor issue. This EGR system uses a Differential Pressure Feedback (DPFE) sensor and a vacuum controlled EGR valve that uses a solenoid to control the vacuum flow to the valve. A quick visual inspection found that the vacuum line nipple going to the valve was cracked. Z



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.

 $\equiv$  Email G. at gtruglia@tstseminars.org

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TRUE STORIES FROM THE SERVICE BAY

# **CRUISERS THAT WON'T CRUISE SMOOTHLY**

### WHEN IT KEEPS COMING BACK, THE PROBLEMS SEEM TO COMPOUND INSTEAD OF BECOME CLEARER.

### BY RICHARD MCCUISTIAN | CONTRIBUTING EDITOR

verybody who pulls a wrench has run afoul of vehicles with bulky engines stuffed in very small engine rooms. I wonder sometimes if at least some of the vehicle manufacturers have returned to the old "stovepipe" way of doing things, where design engineers would come up with a body they liked and then send the prototype up the pipe to the powertrain folks, usually with the instructions to cram an existing engine/transmission platform into the new body.

Sometimes an existing vehicle that was produced originally with a sensibly sized engine compartment gets a powertrain upgrade that fills that engine compartment to the max. One



### OVERHEATING BOOMERANG

2005 PT CRUISER Vehicle Year/Make/Model 83,565 Mileage 2.5L V6 Engine 41TE TRANSAXLE Transmission A REOCCURING OVERHEATING PROBLEM Vehicle Complaint example of this is when Ford decided to cram the Duratec V6 in the same place where the Vulcan Y block fit so well. Granted, the Duratec has been a lasting engine design that runs like a champ, but it appropriates every available cubic inch of space in the powertrain compartment of the second generation Taurus.

The PT Cruiser and the VW Beetle are pretty much the same way, even equipped with their four bangers, and when you shoe-horn a Turbocharger in there, it makes things even tighter.

Retro vehicles became a hot item about 15 years ago, with cars like Ford's reintroduction of the Thunderbird, the rebirth of the VW Beetle, the limited edition Plymouth Prowler, Chevy's HHR, Dodge's Challenger, Chevy's Camaro and the venerable little PT Cruiser, which has been just about as popular as the Beetle.

This story is centered on a PT Cruiser that came to us from a regular customer who has owned several of these curvy little rides. We've done everything from timing belts to radiator cooling fans to transaxles on PT Cruisers for these folks. This time, the problems the PT had were not so cut and dry, and the last thing I want to do is dump a bunch of high dollar work into a vehicle before I know for sure what's needed.

### **Honeymoon Purchase**

The son of a retired colleague of mine had purchased this clean little convertible PT while he was on a honeymoon trip with his new wife in Florida. They had been driving the car around for about five days sightseeing when it sprang a coolant leak, so they visited a shop down in Florida.

They were told the engine oil pan would need to be replaced at a cost of \$500, and the oil had been drained from the pan. The car had been driven in for service, and now, because of the oil pan problem, it was wrecker fodder. This young owner was somewhat disillusioned as to how a coolant leak on a vehicle he had been driving for several days could morph into a \$500 oil pan replacement. He placed a call to Mom and Dad, who took a trailer and spent 16 hours or so retrieving the Cruiser, which wound up in one of my service bays.

The first thing I noticed when I got it on the lift was a short <sup>3</sup>/<sub>4</sub>-inch coolant hose that had been replaced along with the new clamps. It seemed to me that during that hose repair the shop had noticed that the engine oil pan was sporting a rubber drain plug, which they might have dislodged while replacing that kind of hard-toget to hose. When they saw that the threads in that aluminum pan had been stripped out, they priced out an oil pan

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and the labor to replace it. And, to be honest, I can sort of understand what they were thinking. In this litigious society of ours, the last thing they wanted Probably, but these tips was for a customer to get a few miles can improve your work. down the road after their repair to have that rubber plug pop out and weld the engine together. So they priced out the oil pan to protect themselves as well as the customer.

That being said, a traveling customer will usually balk at a \$500 estimate under circumstances of this kind. In other words, the shop didn't actually do anything wrong, but when a customer goes in for a coolant leak and gets an estimate like that, especially when they're eight hours south of home, they aren't likely to pony up with half a grand to pay for something they aren't sure about with the kind of family lifeline that was available.

In my service bay, the first order of business for us was to decide what could be done short of replacing the oil pan. I've fixed problems like this before by installing one of those steel spark plug bushings and a 14 mm 1.25 thread pitch drain plug. Usually, that is a permanent repair that works very well on an aluminum oil pan, but in this case, I made the mistake of having an inexperienced student operate the thread tap.

He didn't understand the physics of turning a tap on its axis rather than recklessly yanking on it while cutting those new threads. Thus he made a mess of what would have otherwise been a

flawless repair. Now the hole was too big for my original plan. This goes under the heading of "Why Teachers Go Gray."

I called the parts store and ordered an 18 mm drain plug with the same thread pitch as an oxygen sensor, but that parts store couldn't get a thread tap without my having to wait

five days for it.

The next day, I took my own thread tap to the shop from home (every mechanic should have one of these to fix the threads in  $O_2$  sensor holes), and I used it to bring that hole out to 18 mm. I then installed the drain plug for a good, solid repair, complete with a new oil filter and fresh oil. We also noticed that, even with the engine idling, the oil light was on all the time, and they hadn't complained about that, but I ordered a replacement sensor and the light was extinguished. Problems solved, right?

### Many Happy Returns

The son who owns this car lives about 100 miles to the north, and so, before delivering it to him, his parents drove it around for a few days and found that, while it ran cool most of the time, it would sometimes run warmer than others, i.e., a bit too far above the center of the gauge for their comfort. I asked if the warmer times were happening in traffic or at the drive-thru, and they said they had noticed it on the highway but not in town. We did the cheap and easy and popped a new thermostat in,



The engine compartment photo illustrates just how tight things get. These little cars love to overheat for any number of reasons, not the least of which would be cooling fan failure.



re-bled everything, made sure it was full of coolant, and sent them on their way again.

They drove it a few more days without incident, then headed off to the north to deliver it. They spent a day or so up there while their son drove it around (they're retired), and he made an 80 mph interstate run to another city. On that trip he experienced some mild overheating, along with a flickering oil light. And so the PT returned to us again. To begin, we replaced the oil sending unit again, swapping the original one out as defective, but not before checking to see what the actual oil pressure was. Even with the engine toasty warm and idling, the actual pressure was a comfortable 30 psi.

The block was full of coolant, and even had the right level in the surge bottle, but we pressure-tested and double-checked everything. The fan was fine (no dark commutator segments during my roulette test, and it kicked



Here's the 2010 Diesel Jetta that went in the drink a couple of years back. The owner removed the radio because the water was deep enough in the passenger compartment to wet it, but you can't look at the interior and tell it has been wet at all. The odometer shows just over 9,000 miles; this one is definitely worth fixing.

# **BE SYSTEM SMART**

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

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



INSPECT

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REPLACE

9

- K -

off and on), and the engine temperature the whole time we were checking it and driving it. I reasoned with the customer that, since this one is a turbo, driving it at 80 mph might push some compression past the head gasket into the water jacket under extreme conditions, especially since the problem doesn't happen at 65 mph but does happen at 80-plus mph. My suggestion was that they drive it around for a few days to see if they could duplicate the problem at normal speeds, because we couldn't, and I don't drive 80 mph on any customer's car. They agreed and planned to keep a close check on the coolant level, noticing any other patterns that might emerge.

### **In-Between Jobs**

In the meantime, these same folks brought a 1997 Chevy Van with an A/C  $\,$ 



This is my usual fix for stripped oil drain plugs on the aluminum ones. Steel oil pan will wear out several oil drain plugs, but when the threads on these aluminum pans give way, it makes sense to do something dependable, quick, and creative. The spark plug bushing method usually works flawlessly, but you need a steady hand on the tap, else you'll have to go up a size like we did here.

leak. When we applied dye with the refrigerant charge, ran it for a while and shot it with the black light, the compressor lit up like it was radioactive. That one got a compressor, a new orifice, an accumulator and a gaggle of new O-rings. While the front registers were shoving artic air into those two seats, the rear unit still wasn't cooling. It probably needed an expansion valve and some flushing, but they needed to use the van, so we would address that when we were done with the PTs and they had time to release the van for awhile.

Another interesting vehicle we took in was a 2010 Diesel Jetta with 9,000 miles on it that belonged to an electronics engineer. He had driven the car into a deep ditch of water a couple of years earlier and it hadn't started since. The car looks brand new; it didn't look like it had been wet inside – the carpet was pristine and there was no mud anywhere. But then, the car had been sitting in his yard for two years as a nostart. The interesting thing about this one was that he had replaced every controller he could get to with salvage yard units, and he had removed the radio because it had been wet as well.

What that meant to me was that the Jetta had been chest deep to the driver on the inside of the car, usually the kiss of death for all manner of electronics. Nothing would talk to the J2534 flasher or any scan tool, and when I called Joey Henrich at AE tools, he told me that nothing would talk on that Jetta unless a factory radio was installed. Further, if an aftermarket unit was installed, the scan tool would be fried as soon as it was connected. I sent the Jetta's owner in search of a replacement OEM radio, and that job wound up on hold. We also had a percolating Caravan because of a Chinese radiator and a wire harness issue on a 2000 Ranger that had disabled the A/C.



This was the reason for an inoperative A/C on a 2000 Ford Ranger. This self-proclaimed "electronics guy" had been tinkering with this truck and bypassing circuits for a solid year trying to patch his A/C. My guy used a wiring schematic and a visual inspection to find this harness rubbing against the EGR pipe. It was a fairly simple fix.

### Another 'Happy' Return

The next happy return on the PT happened when they discovered the coolant was low in the surge bottle, and when they tried to add coolant to bring it to the line, it went straight to the pavement – fingering a brand new breach in the surge bottle. Further, they had seen the oil light flickering again, and this was getting peculiar enough that I was wondering if the oil sending unit wire was shorted to ground, but we couldn't locate a short.

I did notice in passing, however, that disconnecting the unit seemed to cause that light to illuminate (sometimes), which makes normal diagnosis of a circuit like this kind of troublesome and misleading. That led to an Identifix search, which revealed that quite a few shops had seen flickering oil lights because of aftermarket oil pressure switches on Cruisers. Because we had to order a surge tank to replace the newly cracked one on that PT, we snagged a \$25 oil pressure sender from Chrysler on the same order and swapped that pressure switch out again.



This was the positive battery cable on the same van. It always has been pretty interesting to see how much trouble some DIY folks (and backyard shops) will go to in their attempts to dodge putting a new cable on one.

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Then came the other PT Cruiser these folks own, this one a 2002 model hard top. They reported that they'd had to add over a gallon of coolant because it had tried to run hot like the 2005 Convertible had. But pressure test as we might, we couldn't locate any leaks, and the cooling system was full, as was the surge bottle on that one. I asked them about the last time anybody had checked the coolant and they couldn't remember – said it had been months. My prognosis was that it was probably seeping into one or more cylinders and making its way out the tailpipe over time. If coolant is leaving and there is no leak, that's the only answer that makes sense.



Here's another DIY miracle. The guy who drives this 2000 Chevy Silverado was having trouble getting his truck started and somebody told him to hit the starter with a hammer. He thought this was the starter, and well, the rest is history. Amazingly, the alternator still puts out.



### Explanations and Scheduling

That postulation of mine led them to ask how the problem they were having with this PT differed from the other one, and so I shifted into teaching mode, and my answer was that the other one had a turbocharged engine and only overheated at high speeds. That would be, according to my hypothesis, a migration of the fire from the power stroke on at least one hole shoving heat past a compromised head gasket into the coolant.

This 2002 PT, however, was a different story. It would be seeping coolant into the cylinders rather than letting compression pass in the other direction. Just about engine guy has dealt with both these types of head gasket failures, but coolant migration into the combustion chamber with the engine running has always seemed counter-intuitive to me simply because of the pressure differential between the coolant passages and the combustion chamber. My notion is that most of the coolant migration takes place as the engine is cooling, but that generally causes issues on cold startup, and sometimes they don't have that kind of symptom even though coolant is being swallowed by the combustion chambers.

We ended that conversation with the agreement that they would monitor the 2002 Cruiser to gauge the rate at which the coolant was leaving, and that they would monitor the 2005 PT for overheating at normal speeds. One way or another, both of those cruisers will probably need head gaskets, but that won't happen until this fall, because the semester was at an end. Sometimes I have to kick the can down the road until the time is right, and both of these Cruisers can cruise until it's time to do the work. Z



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.

 $\neq = 7$  E-mail Richard at rwm19@mail.com

# GATES PREMIUM TURBOCHARGER HOSE KITS

urbocharger hoses are designed to serve two functions - absorb normal engine vibrations and provide a means of connection for the pressurized air conveyance between the various components in the system. Unfortunately, turbocharger hose failure remains an all-too-familiar concern for many diesel truck owners. This is because the original equipment hoses cannot reliably withstand the extreme operating conditions, temperatures, and exposure to oil that these hoses are constantly subjected to. The result is premature hose failure, normally in the form of hose blow-off or rupturing. A failed turbocharger hose will illuminate the check engine light in addition to causing numerous drivability concerns, the most noticeable of which being a severe loss in performance. Air flow through a turbocharged engine is designed to be closed, so when one of the hoses fails, boost pressure is immediately lost.

Moreover, continuing to operate the vehicle drastically increases the likelihood of dirt and other foreign contaminants entering the engine and the turbocharger, which may contribute to catastrophic component failure. Couple this with the fact that many of these hoses are only available from the dealer as part of expensive assemblies, and you have a real problem. Further exacerbating this problem is the fact that the OE parts do not come with replacement clamps, which can lead to multiple trips to the local parts store in an attempt to find suitable replacements. Ultimately, no one wants to be stuck broken down on the side of the road, especially because of something as trivial as a turbocharger hose.

After a thorough analysis of the original equipment system and components, Gates' engineers identified



several shortcomings pertaining to the hoses and securing clamps. Many of the OE turbocharger hoses fail to utilize any form of an oil-resistant inner liner, while others employ a less robust fluorosilicone inner liner. Both designs result in premature hose failure as oil will eventually permeate through the inner liner. Furthermore, the OE hoses are often secured using standard worm-gear clamps, which are also not ideal as they require periodic adjustment to maintain proper tension. The inferior clamps only increase the likelihood of premature hose blow-off.

As a result, Gates has designed and engineered a full line of Turbocharger Hose Kits for Ford, Dodge, and GM Diesel Pickups. Each kit contains a superior quality turbocharger hose in addition to two premium T-bolt clamps, which allows you to perform the complete repair the first time. All Gates turbocharger hoses utilize a specially bonded fluoroelastomer liner, which exhibits increased static friction on the coupling. This results

in superior protection against degradation due to oil permeation in addition to acting as a barrier to harmful exhaust gases. Moreover, the T-bolt clamps included in every kit possess a stainless steel band and bridge that resists corrosion, all the while providing consistently better sealing characteristics than the standard worm-gear clamp. In fact, a recent comparison of several original equipment turbocharger hoses and the Gates turbocharger hoses proved the superiority of the Gates hoses as they withstood 23% higher pressures than the OE hoses. This, coupled with the premium T-bolt clamps included in every kit, make Gates the obvious first choice for all your turbocharger hose needs.

Gates' expansive line of premium Turbocharger Hose Kits now covers Ford Power Stroke Diesel Pickups, Dodge Ram Diesel Pickups, and Chevy Silverado/GMC Sierra Duramax Diesel Pickups. Furthermore, Gates now offers numerous OE-Exact turbocharger hoses for many popular European turbo diesel passenger cars. Please visit www.gates.com/turbochargerhose for more information, including application information and part numbers, or www.gates.com to find a distributor near you.

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NAPA Total Eclipse® loaded (LE) calipers are pre-loaded with quality OE-grade friction, OE-style seals and bleeder valves, and an exclusive protective coating, which acts as a rust inhibitor and protects against salt spray and moisture. New hardware is included and installed (where applicable), reducing the risk of future leaks or uneven braking or pad wear that can be caused by calipers hanging up or dragging. Precise lubrication of critical areas prevents the caliper from binding.

Giving service providers the freedom to choose the friction material for the brake jobs they perform, NAPA Total Eclipse semi-loaded (SE) calipers have an exclusive protective coating and are available bracketed and non-bracketed. Applicationspecific rear hardware is included and installed (where applicable), and the calipers feature the same OE-style seals and bleeder valves as Total Eclipse loaded (LE) calipers, along with precise lubrication of critical areas.

In addition to the quality features that are built into the NAPA Total Eclipse Calipers, a free 2-year/24-hour roadside assistance program covering jump-starts and towing is included with every purchase.

### The perfect brake job

Because not all brake parts wear at the same rate, it can be difficult for a driver to know when or what parts need replacement. Whether doing a routine inspection or replacing worn parts, The Perfect Brake Job® from NAPA Brakes provides reliable, step-by-step inspection and replacement procedures.

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# ELIMINATING STEERING AND SUSPENSION NOISE IN CERTAIN GM MODELS

ere are procedures for eliminating steering gear squeak noise and front strut noise in certain General Motors models:

To prevent a steering gear squeak noise on 2008-2012 Buick Enclave, 2009-2012 Chevrolet Traverse, 2007-2012 Acadia and 2007-2012 Saturn Outlook crossovers built prior to July 1, 2011, GM recommends that the power steering fluid be changed to DEXRON-VI automatic transmission fluid when a steering gear assembly is replaced for any reason.

The original cause of the squeak noise may be due to insufficient grease in the pinion shaft seal. The pinion shaft seal to pinion strut interface and lack of lubrication may generate a noise. This noise originates in the gear but may sound like it is coming from the steering column area. The steering gear assembly should not be replaced for this squeak noise condition. For the squeak noise, only the steering gear housing should be replaced, and the power steering system should be refilled with DEXRON-VI, which offers the permanent correction for the squeak noise.

In addition to the squeak noise correction, the recommendation to convert the power steering fluid to DEXRON-VI is for gear replacements only and not for repairs to other system components, such as the pump, cooler or hoses.

A tag identifying that the vehicle has been converted to DEXRON-VI should be installed on the power steering reservoir filler neck and secured with the cap.

If the power steering system on these vehicles has the original fluid, the system should be flushed and refilled with DEXRON-VI. Due to the interface between the pinion shaft seal and the fluid, it is critical to ensure no fluid comes in contact with the new seal. Be sure to thoroughly flush all old fluid from the system prior to installing the new steering gear assembly or housing.

When changing the fluid, raise the vehicle until the wheels are approximately 24 inches off the ground. Disconnect the power steering fluid reservoir inlet hose from the power steering fluid reservoir and plug the power steering fluid reservoir inlet port. With the key ON and the engine OFF, turn the steering wheel fully to the left and to the right while an assistant maintains the minimum fluid level in the reservoir using DEXRON-VI fluid. Continue until the fluid from the power steering fluid reservoir inlet hose turns red. This may require up to three quarts of DEXRON-VI fluid.

### **Eliminate front strut noise**

In certain 2008-2014 Chevrolet Captiva Sport; 2010-2014 Chevrolet Equinox and GMC Terrain; and 2008-2009 Saturn VUE models, a popping or clunk noise coming from the front of the vehicle may be heard during small- to medium suspension travel. This condition may be due to the inside diameter of the front strut jounce bumper rubbing against the piston rod of the strut, creating a slip-stick condition. To correct this condition, apply grease to the top and bottom of the strut shaft.

With the vehicle raised on a frame lift-type hoist, pull the dust shield/jounce bumper assembly out of the strut top mount cup and slide it down to expose the top portion of the strut shaft. Apply grease (GM P/N 12345579; in Canada 10953481) around the circumference of the strut shaft that is exposed.

Unseat the bottom of the dust shield from the strut and expose the bottom portion of the strut shaft. Apply the grease around the circumference of the strut shaft that is exposed.

Slide the dust shield/jounce bumper assembly down and reattach the bottom to the strut. Push the top of the dust shield/jounce bumper assembly up into the top mount cap as far as possible by hand. The assembly will fully seat once the vehicle is on the ground and suspension is allowed to compress.



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# WHEN SHORTCUTS ARE Not a good idea

hortcuts, many times they are great. They save us time, they save us distance and they save us extra work. As a technician, you utilize short cuts every day. It may be that new tool that allowed you to complete the job 20 minutes sooner, or a new technique to execute a repair that a new tech brought with him from his old shop. Remember that first time when you saw someone unbolt the pick-up truck box so he could raise it up in order to get to the fuel pump located on top of the fuel tank? I remember the first time I saw that. I also remember the other technicians standing around in a group laughing and making jokes about this unorthodox way of replacing a fuel pump. The rest were all old school on this. Raise the vehicle up, unbolt the straps (hopefully not rusty and they don't break), raise the jack up under the tank, bring the tank down and hope and pray that the tank is not full of gas and that you disconnected every fuel line. That is the way it has been done for years. If it ain't broke, don't fix it, right? We have heard that expression for years.

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

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

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

That is what has been done with the new line of FVP Hubs and Bearings. As well as all of the other products offered by FVP, which are exclusively distributed by Factory Motor Parts. FVP parts are engineered to provide OE quality that is equal or superior to the national brands. No shortcuts here.

Maybe a better word for a positive shortcut is process improvement, unless it is a faster way to get to grandma's house for apple pie. Now that is a shortcut. So maybe when it comes to parts, is it cutting corners or a shortcut? We will let you decide.

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Factory Motor Parts is a trusted distributor to professional service centers for almost 70 years. FMP has you covered for all of your parts needs. For more information, visit www.FactoryMotorParts.com.

# **GET YOUR SHOP SERVICE READY**

hat is service readiness and why is it important? Mark Saxonberg of Toyota said it best: "Service readiness is the act of having received the service training, information, tools and parts necessary to perform any diagnosis, repair and/or adjustment that might be required to support a product, in advance of product arrival for repair."

For the aftermarket that means being ready to service or repair a customer's vehicle before it arrives at your shop. Let's put it in context - if a regular customer drops by to have you change the oil on their 2011 Cadillac CTS that is equipped with an engine requiring dexos1 oil, and you don't have the oil in stock, are you service ready?

If that same customer brings their 2012 Kia Sedona with the MIL on and a complaint of low idle and no power, would your team be able to handle the issue? Or would they have to go to service information school first?

A shop that is not service-ready might treat the Kia in the following manner. A tech drives the car and confirms the reported problem. Using a scan tool, the tech pulls codes and finds a P0638 Throttle Actuator range/performance. He locates a TSB that points to earlier models needing a Throttle Position Sensor and either a) test the TPS, find no problem, clear the codes and ship the vehicle or b) test the sensor, find no problem, change the TPS to be safe, clear the codes and ship the vehicle, only to find the same Kia with the same problem and code in their bay the next day.

Ultimately, the shop sends the Kia to the dealer. The dealer technician, who happens to be service-ready, drives the vehicle, and because of his training, recognizes the engine is in a de-rate strategy where the PCM has commanded the throttle actuator closed because of a potential problem with either the TPS, the actuator or another component that might cause ultimate damage to the engine. Even an issue as benign as low oil pressure or overheating could be the root cause. Checking under the hood, the dealer tech finds a low-quality oil filter. The filter is changed, and the oil pressure is restored, curing the need for the PCM to protect the engine by limiting throttle performance. Two technicians approaching the same problem, with very different results.

Your shop can take the necessary steps to become service-ready by incorporating the following into your regular business:

• Provide quality training for your entire team. Training is a pillar of service readiness; consider that your sales and customer service team must be every bit as service ready as your technicians.

• Have you ever taken in a vehicle that you can't possibly fix? You need access to OE service information and technical support to help your staff solve those tough problems. OE level tooling is a necessity so your shop can communicate with the vehicle at every possible level.

• Ensure access to quality replacement parts from a partner that is truly invested in your business.

Most important, deliver unparalleled and exceptional customer service every time, every day, for every customer and teammate. Service readiness is a product of your shop's service standards. A team at Advance Professional is ready to help support your shop in any way we can. For more information about commercial programs available from Advance, call 877-280-5965 or **visit Pro.AdvanceCommercial.com**.



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# FUEL SYSTEM KNOWLEDGE

### **The Problem**

Fuel system repairs are often performed without proper diagnosis, leading to unneeded parts and the inconvenience of doing a complex repair that does not fix the vehicle problem.

### **The Solution**

Basic fuel system troubleshooting and diagnosis can be accomplished with a digital voltmeter and some knowledge of vehicle electrical systems. This article provides some guidelines for system electrical tests.

### System Components to Check First

If the vehicle will not start, check the following:

- Fuel level in tank
- Power at the fuel pump fuse/relay

### **Vehicle System Voltage Test**

1. Connect digital voltmeter positive lead to positive battery terminal.

2. Connect digital voltmeter negative lead to negative battery terminal.

3. System voltage should read 12.4v DC or higher with no electrical loads on the system. If voltage reads less, starting and charging system should be investigated before performing fuel system electrical testing.

### **Fuel Pump Voltage Test**

1. Connect digital voltmeter to fuel pump wiring at fuel pump connector.

2. Turn key on (pump will only have voltage for a few seconds).

3. Measure voltage at pump. Reading should be within 0.5v DC of system voltage.

### Fuel System Voltage Drop Test

1. Address the negative side of the circuit first, then the positive side.

2. Connect one digital voltmeter test lead to the negative battery terminal and the other to the negative terminal at the fuel pump.

3. The fuel pump circuit must be energized to properly test. Energize the fuel pump relay and power the fuel pump circuit (see NOTE below).

4. If the negative circuit is in good condition, the voltage drop measured should be 0.5v DC or less. Larger voltage drop readings indicate a problem. Damaged or corroded vehicle wiring or harness connectors are likely sources of the problem.

5. Repeat the voltage drop test on the positive side of the circuit. Connect one digital voltmeter probe to the positive terminal on the battery and the other to the positive fuel pump terminal.

6. Energize the fuel pump relay and power the fuel pump circuit (see NOTE below).

As with the ground circuit, voltage drop readings larger than 0.5v DC indicate system wiring or connector issues

NOTE: The majority of fuel pumps run for only a few seconds once the relay is energized (only long enough to prime the system) until an RPM signal is generated. Some vehicles may require a scan tool to trigger the fuel pump. Refer to the service information for your specific vehicle.

### Technical Information Brought to You by AIRTEX

To get more technical tips, tricks and in-depth "how to" information and videos, go to **www.FuelPumpU.com**. Fuel Pump U is created and managed by the professionals at AIRTEX, who have over 75 years of automotive aftermarket and OEM experience. Headquartered in Fairfield, IL, AIRTEX manufactures a









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# **ONE CALL, ONE ORDER**



lder, high-mileage vehicles are no problem for Magneti Marelli Offered by Mopar<sup>®</sup>.

### **Serving All Makes**

The semi-arid climate of eastern Oregon is easier on vehicles than places that experience more precipitation and greater weather extremes. Because of that, we see lots of old and/ or high-mileage vehicles at our shop.

A regular customer who recently purchased a high-mileage 2003 Toyota 4Runner brought it to us for service. While the well-used 4Runner's body was mostly rust-free, it was in need of the type of service that 10-plus-yearold vehicles with well over 150,000 miles on the odometer often require — a new battery, new brakes, and routine maintenance, including replacement oil and air filters.

The customer, whose other vehicles are Chrysler Group products, brought the 4Runner to our shop because he was happy with the timeliness and quality of our service – and because the nearest Toyota dealer is more than a one-hour drive away.

### Magneti Marelli Quick Delivery

Conveniently, the local wholesaler for Magneti Marelli Offered by Mopar<sup>®</sup> parts — the same dealer that provides Mopar<sup>®</sup> parts for Chrysler Group vehicles — is located only 10 minutes from our shop. Wanting to get the parts in a timely fashion, I called them and inquired about Magneti Marelli allmakes parts for the 2003 4Runner. Happily — and predictably — everything was in stock and, once the order was placed, the parts were delivered in less than an hour.

### One-Day Service, Quality Parts

Once the high-quality front and rear brake pad kits, battery, and oil and air filters — all manufactured by Magneti Marelli and engineered to meet O.E. standards — arrived at the shop, we were able to install them right away and provide same-day service. This would not have been possible had we not been able to source the parts through our wholesale dealer.

### **Competitive Pricing, Satisfied Customers**

In addition, the competitive pricing of Magneti Marelli all-makes parts means that the cost per unit was less than if we had called a distributor of imported car parts. Now my customer knows that he can bring all his vehicles to our shop, no matter what brand or model, and can count on our shop's convenience, quality, quick turnaround and reasonable pricing, enabled by our local Mopar<sup>®</sup> and Magneti Marelli wholesale dealer.

If your shop regularly services a diverse array of makes and models, ask your Mopar dealer about Magneti Marelli. You'll be glad you did.

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OWER

### TECH TIPS

# BATTERY SERVICE AND REPLACEMENT

POWER

o one misses their battery until it's gone. You can help your customers avoid getting stranded by testing every battery that goes through your shop.

The first step is to inspect the battery and cables. Look for signs of corrosion, terminal damage, cracked case, bulging at the case ends. Wipe the dirt off the top of the battery and clean any corrosion that may be present.

If the battery has vent caps, lift the caps to check the electrolyte level and add distilled water if needed being careful not to overfill.

The old carbon-pile tester you may have sitting in the corner is so last century. Today there are digital load testers that will test the battery, starter, and alternator in less than a minute. That's a minute well spent to give your customer peace-of-mind and alert them to potential problems -before they happen.

If you have customers who don't drive their vehicle often, or who don't go very far when they do, their battery may need more frequent monitoring. A battery will begin to sulfate when the battery's open circuit voltage (OCV) drops to 12.4 volts or lower.

Sulphation leads to shorter battery life. When a battery rests in a low state of charge, the electrolyte contains less sulphur. Where did it go? It's resting on the grids and will crystallize there leaving less active surface area to conduct electricity.

The vehicle's alternator is designed to maintain a fully charged battery and not designed to fully charge a discharged battery. If you see OCV at 12.4 or lower, charge the battery with an external charger - microprocessor-controlled chargers will give you be the best results.

You may want to discuss options with your customer to maintain a full charge. The solution may be to drive the vehicle more or to use a battery maintainer while the vehicle sits.

### The Right Replacement Battery

When you've determined the battery needs replacing, all replacement batteries are the same, right? Actually, they're not. The quality of a battery's positive grid will determine how dependable the battery will be.

There have been recent advances in battery manufacturing that help make one battery be more reliable than another.

In warmer climates where high cold cranking amps (CCA) are rarely needed, batteries with thicker grid plates and lower CCA tend to outperform batteries with thinner grid plates and higher CCAs. The thicker grids resist corrosion better than the thinner plates found in cold climate batteries.

Another advancement is the method used to create the grids. The most reliable grids are now made by rolling and stamping the lead - like a coin. Stamped grids are stronger and resist corrosion better than grids made with older methods like casting.

Newer car models are coming with more power-hungry electrical accessories. SUVs and trucks continue to be popular choices. Some are driven in rugged conditions. These vehicles need a more capable battery. Absorbed Glass Mat (AGM) batteries have a spill-proof design that won't leak acid, resists vibration, and conducts electricity better than their flooded cell counterparts. AGM batteries offer the highest performance available today.

For better performance, ask your battery supplier for batteries that have:

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If you're looking for a supplier that offers the options and the level of quality your customers deserve, AutoZone can help. They offer the right testers, the right batteries, and the right level of service to meet your customer's needs.







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# BE SYSTEMATIC WHEN PERFORMING BRAKE SERVICE

complete brake service restores the braking system to its original operating condition. Keep in mind newer technologies like Electronic Stability Control (ESP) depend on the basic braking system being in good operating condition and don't know if the system was serviced correctly the last time around.

The success of any brake service depends on many factors, but should always follow a systematic process to ensure you see the overall condition of the brakes system and don't miss anything. Here are the steps at a high level:

- 1. Perform an initial brake inspection looking for unusual brake wear issues. Look for uneven pad wear, leaking hydraulic components, check the brake lines and hoses, etc.
- Replace or resurface rotors and/or drums according to manufacturer recommendations.
- Inspect and/or replace brake hardware according to manufacturer recommendations.
- **4.** Inspect and/or replace brake fluid according to manufacturer recommendations.
- **5.** Install replacement brake parts that properly fit the vehicle.
- 6. Road test the vehicle after the brake service to ensure proper brake operation. (Tip - an infrared temperature gun can help you determine if all four brakes are operating correctly following a brake service.)

You might be wondering about item number five. Why the need to check for properlyfitting brake parts during the brake service? Figure 1 shows an example of a brake pad that was not properly designed to fit this vehicle. As you can see, there is excessive space at the top of the brake pad; so even though the pads were recenty-replaced, this customer might complain about an intermittent clicking noise in the front of the vehicle when braking in forward and reverse.

Using feeler gauges, Figure 2 shows the amount of material missing from the brake pad for proper fit.

The clicking noise was coming from the brake pad walking in the caliper bracket. The technician did use some brake pad glue, but the small size of the brake pad caused the adhesive to break loose from the caliper. In this case you can easily move the brake pad front-to-back and top-to-bottom.

Figure 3 shows a properly-fitted brake pad. The pad is the right length and fits correctly in the caliper bracket.

Always remember to check replacement parts for proper fit and if something does not look right stop and ask some questions. You can perform a really top-notch brake service, but if the parts do not fit correctly you might end up with a come-back, which will cost you time, money and customer confidence.

For your customers who demand the very best, choose Bosch QuietCast<sup>™</sup> Brake Pads. They're manufactured under the same exacting quality standards as Bosch OE brake components and systems, and undergo rigorous physical and dynamometer testing to deliver quiet operation, durability and long life.



Figure 1: Improper brake pad fit - note excessive space at top



Figure 2: Amount of material missing from the brake pad



Figure 3: Properly-fitted pad



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# A NOT-SO-REMOTE Possibility

ver been stressed over a frustrating steering complaint? Perhaps you even tried installing several different power steering pumps and/or steering units only to still have noise or lack of assist issues you can't seem to repair! If so, you're not alone.

CARDONE Industries regularly fields this sort of phone call through its Tech Advisor Hotline. In many cases, the problem isn't the pump or the steering unit — it's the remotely-mounted power steering pump reservoir.

### **The Problem**

Many late-model vehicles now use remote-style power steering reservoirs, which incorporate a fine-mesh screen to trap contamination and prevent it from entering the power steering system. The screen prevents contaminants from damaging healthy power steering components.

However, a major drawback to this design is that these reservoirs do not have bypass capability like an engine oil filter does. This means that once the screen becomes clogged, the system begins to starve itself of power steering fluid, leading to noise, lack of assist and/or premature power steering pump failure.

As you can see in the photo example, the screen is almost completely obstructed and will not allow a sufficient flow.

### **The Wrong Solution**

Unfortunately, some vehicle owners and technicians punch a hole in the mesh screen to allow fluid to once again flow freely into the pump. This may temporarily solve the problem, but is a very dangerous repair method. All the debris that once was caught by the screen is now allowed to travel through the pump then the lines and into the spool valve of the steering unit. This will almost certainly cause future problems in the steering system. The O.E. engineers included the screen for a reason – do not damage this simple, but vital element of the system.

### **The Right Solution**

The proper fix is to simply remove the reservoir and clean the screen with an aerosol carb cleaner or brake cleaner. Once



Obstructed power steering remote reservoir screen is often the culprit for steering issues.

the screen is cleaned, use low-pressure compressed air to ensure the cleaning fluid has fully evaporated. If cleaning chemicals contaminate the power steering system, they can seriously damage O-rings and seals.

Once the reservoir is completely dry, make sure the screen is clear by pouring fresh power steering fluid approved for that vehicle through the reservoir. If it flows freely without restriction, the screen is clear.

Before re-installing a reservoir on units that bolt directly to the pump, make sure you lubricate the new O-rings that were supplied with the pump with fresh power steering fluid.

For remote reservoirs that connect to the pump via a fill hose, carefully inspect the hose to ensure it has not collapsed. Over time, it is common for this fill hose to soften, which allows it to collapse and starve the pump for fluid, repeating the same problem the clogged screen presented. If the reservoir is damaged or cannot be cleaned properly, CARDONE offers many popular reservoir part numbers.

### **CARDONE** is Here to Help You

Running into installation problems? Can't figure out which CARDONE part you need? Call

CARDONE's Tech Advisor Hotline at 888-280-TECH (8324). Mon-Thu 8am-6pm, Fri

For a video version of this article, scan this QR code.



8am-5pm EST.

# We're tearing away perceptions of late-model, high-tech parts.



### Is the O.E. dealer the only place to turn for late-model, high-tech parts? They sure want you to think so — but CARDONE has another solution.

Our products go through a rigorous re-engineering process, often resulting in improvements over the original design...but at a much lower cost. Each product is also backed by our industry-leading technical support, ready to help with any installation questions or concerns at **888-280-TECH**.





















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# AVOID THE MIL AND CEL WITH OEM

**By Dan Caciolo,** Head of Product Marketing - Engine Management & Fuel Supply

wise man once said, "The bitterness of poor quality lingers long after the sweetness of low price is gone." This could not be a truer experience for even the most savvy of shops, when the issue involves engine performance and fuel delivery. If isn't done right the first time, you're gonna get the light. As you may know, a big part of doing it right, when replacing components in a vehicle's engine management and fuel supply system, is using OEM parts you can trust.

We're talking about parts such as mass air flow and manifold absolute pressure sensors, electronic throttle valves, air actuators, fuel injectors and fuel modules. The

big problem is that these parts are typically sourced from the 'OE dealer only' and usually come at a very steep price. While there are aftermarket parts out there that cost less, they may not deliver the required level of OE quality and performance. These non-OE parts may look and fit the same, but they may not work the same.

Engine management and fuel supply components are essential to the vehicle's well being, and can directly affect overall drivability, power response, efficiency, fuel economy...and in some cases, even warranty. You don't question the quality of your work and you shouldn't have to question the quality of the parts you use, either.

#### New VDO 'OEM Only' Parts Program

The good news is that Continental has an unbeatable solution for today's independent shops and service technicians with its new VDO Engine Management and Fuel Supply Program. This program offers an exceptional range of premium VDO branded 'OEM-only' replacement parts at very competitive prices. These parts come directly from the manufacturer - Continental, and they are the same parts that are supplied as original equipment components to vehicle manufacturers around the world. VDO is a trademark of the Continental Corporation, and the VDO Program features formerly 'dealer only' Electronic Throttle Valves, Air Actuators, MAF and MAP Sensors, Fuel Injectors and Fuel Modules. These high quality, OE parts deliver excellent European, domestic and Asian coverage for popular and high volume vehicles, as well as hard to find applications.

Remember, all aftermarket parts are not created equal, but all OEM parts are. So when it comes to servicing engine management and fuel supply systems, you'll want to do it right and keep off the light. Your best choice is VDO OEM Only Engine Management and Fuel Supply replacement parts.

For more information, visit vdo.com/usa or contact salessupport-us@vdo.com.





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## A FUEL TRIM ISSUE CAN EASILY BECOME BE A CONVERTER PROBLEM

#### By Jack George,

Advanced Emissions Specialist

ehicle fuel trim can be very valuable in diagnosing converter problems. It will give a clear window into the heart of the fuel control system and how it is working. Any fuel trim issue, if left unchecked, will eventually have an adverse affect on the converter.



#### **Understanding Fuel Trim**

A vehicle's computer system uses fuel trim to help maintain the ideal air/fuel ratio for complete combustion (stoichiometry) – 14.7 parts air / 1 part fuel. In order to work at maximum efficiency, three way catalytic converters need the mixture to be constantly driven rich/lean around this ratio. Fuel trim can also compensate for other vehicle issues. That's why fuel trims are so useful. They can help identify problems such as an intake manifold vacuum leak (positive fuel trim - lean) or a stuck open fuel injector (negative fuel trim - rich).

### Short Term Fuel Trim

Short Term Fuel Trim (STFT1 and STFT2) is the computer's immediate response to adjust the air/fuel ratio. In positive corrections, fuel is added to adjust for a lean condition, while negative corrections respond to a rich condition. STFT corrections represent the current engine run cycle and react very quickly to O2 sensor input. If you were to create a large vacuum leak at Idle by disconnecting the PCV hose, the computer would immediately add positive fuel trim to balance the mixture. Short term fuel trim is not stored in Keep Alive Memory (KAM) after shut down and automatically resets to 0 for the next start/run cycle.

#### Long Term Fuel Trim

Unlike STFT, Long Term Fuel Trim (LTFT1 and LTFT2) is learned over time while in closed loop operation. It is stored in the KAM and also used for open loop fuel calculations (like start up and wide open throttle). LTFT is a coarser adjustment and also works to keep STFT within specification.

#### **Diagnosing with Fuel Trims**

Fuel trims can help you zero in on the problem, especially when there are no other trouble codes present. Knowing whether a vehicle is running too rich or too lean will help narrow down your diagnosis. Fuel trims that differ greatly from one cylinder bank to another will also point you in the right direction. Always evaluate fuel trim at idle and at 2,500 rpm.

**Running too rich** – High negative fuel trim corrections can be caused by MAF sensor problems, high fuel pressure, leaking fuel pressure regulator diaphragm, faulty evaporative emissions components, leaking injectors, defective  $O_2$ sensors, exhaust leaks/pinholes before the  $O_2$  sensor, coolant temp sensor problems, and base engine issues such as low compression and incorrect camshaft timing.

**Running too lean** – High positive fuel corrections can be traced to MAF and  $O_2$  sensor faults, vacuum leaks from intake gaskets/hoses, unmetered air (intake snorkel leak), clogged or dirty fuel injectors, fuel delivery issues, and exhaust restrictions such as a clogged catalytic converter.

#### **Diagnostic Tip**

For a suspected vacuum leak, note the fuel trims at idle and increase engine speed to 2,500 rpm and hold. If the STFT immediately decreases and moves to acceptable levels and the LTFT slowly starts to come back down, you may have a vacuum leak. After the repair, reset the KAM and start the vehicle. Monitor the fuel trims to make sure they are within the normal ranges. It could take up to 10 miles of driving for an accurate LTFT reading.

For additional information, call your distributor or **visit www.easterncatalytic.com**.



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# FEDERATED OFFERS PREMIUM BRAKING PERFORMANCE FOR TODAY'S VEHICLES

ederated Auto Parts has developed an addition to its friction offering with a new co-label line developed and supplied by Wagner Brake. The new product line is a premium offering designed for professionals that was exclusively designed for Federated members and their customers.

The line uses the highest performing formulas specific to each application and includes System Synergy Technology (SST) which is an OE approach to brake design that ensures the interaction of all brake components to provide the ultimate performance.

Each set of Federated Professional Premium is engineered and designed to match the OE pad in fit, form and function and uses premium formulations and shims designed for ultimate performance on each application.

The System Synergy Technology focuses on managing the NVH (noise, vibration, and harshness) issues through testing and validation of the various components used in disc pad designs. While many consider a disc brake pad one component it actually consists of many different components including backing plates, shims, hardware, along with friction material, slots and chamfers that all must be designed to work together to deliver ultimate performance.

Working with Wagner Brake experts, Federated has developed a product line that uses OE designs, and improvements in materials and component integration, to deliver superior performance to other aftermarket lines. The Federated Professional Premium line provides superior braking performance, long life and quiet operation for customers who perform premium brake service and have a reputation for using high quality brand name parts.

Federated has a history of working closely with high-quality manufacturers to develop exclusive products designed specifically for use by quality technicians and professional service providers. The Federated Professional Premium line of disc brakes is designed to take all the mystery out of all the different materials and grades available in the market today by using System Synergy Technology to focus on the best solution for each vehicle.

"We spent countless hours working with Wagner Brake experts in designing this line," stated Phil Moore, senior vice president for Federated Auto Parts. "The results from both testing and customer feedback have been outstanding. This new product line delivers premium performance in every area and we believe will be a major benefit to our professional customers.

"Working with Wagner and Federal Mogul made this project easier due to their commitment to quality and their outstanding manufacturing and R&D facility in Smithville, Tenn.," Moore continued. "We are proud to have a premium product line that is made in the USA"

Federated Professional Premium brake uses an OE approach to the design process that delivers the ultimate in overall performance for the professional service provider and is available exclusively from members and affiliates of Federated Auto Parts. For more information, visit www.federatedautoparts.com.









# Meet The Newest Member of the Federated Team

Federated is honored to serve as a corporate partner of the U.S. Marine Corps Reserve Toys for Tots campaign. This holiday season, Federated and its members will be raising money and collecting toys at their stores nationwide that will be donated to Toys for Tots.

For more information about participating or donating, visit http://www.FederatedAutoParts.com/ToysForTots.aspx.

TOYS FOR TOTS

# AIR GUN WITH UNPARALLELED ACCESS

e all know that radiators keep engines cool by allowing ambient air to flow through and dissipate heat from the coolant traveling through the core. For this heat exchange to work, the radiator condenser must be free from debris which impedes airflow. With that in mind, a good diagnostician- when dealing with a vehicle running warm-should first give the radiator a quick cleaning before delving into thermostats and coolant temperature sensors. If the radiator is plugged up, compressed air will certainly give you a visual indicator of the problem. If you've worked on enough vehicles, chances are you have quite a few tales of various foreign objects obstructing radiators.

Up until now, blowing out a radiator was a bit of a chore using traditional long-reach air guns. However, an innovative redesign offered

by IPA called the Air Comb is purpose-built for this task. The Air Comb is the first flush  $90^{\circ}$  blow gun. This design element is the key to its effectiveness. Traditional air guns utilize  $90^{\circ}$  bent tips, which when used to clean areas perpendicular to the tool often results in clearance issues, particularly in close quarters. This is especially true when trying to remove debris from radiators, oil coolers and condensers, which modern engineers seem to love stacking closer and closer together. In these situations, even the smallest 90 degree bent air gun won't fit.

Utilizing IPA's Air Comb (available in 12-inch, 24-inch, 36-inch, and 48-inch lengths), a mechanic can easily insert the tool behind the radiator utilizing the unidirectional flush air output to blow debris toward the grill. Another great feature of the Air Comb is the tool's 5-port tip. This provides greater air volume and covers a wider surface area than traditional single port air guns while making the job much quicker. If the vehicle being serviced has recently been offroad or used in a severe environment, a quick cleaning with the Air Comb should flush out a good deal of debris from the radiator unit which may eliminate problems related to overheating. If problems persist, you can continue down your diagnostic checklist and look into the coolant health, thermostat and coolant temperature sensor as needed. The Air Comb is also very useful in cleaning other critical heat exchanging components which may be clogged as well.



This tool is also excellent for blowing out air filters. Yes, you read that correctly. Despite what you may have heard, it is perfectly fine to blow out debris from air filters in order to prolong their service life- provided you have the correct tools. Because the output volume is focused across the Air Comb's five ports, the tool will not poke a hole in the filter medium like standard single-port air guns often do. It works great with both panel and cone style filters.

The Air Comb is a very handy tool and showcases the innovation happening here at IPA. Keeping one in the shop will certainly come in handy in the above scenario, and trust me, you will find a list of other uses for the tool that your old blowgun just couldn't handle.

Innovative Products of America<sup>®</sup> Inc. (IPA<sup>®</sup>) (OEM) Original Equipment Manufacturer USA 234 Tinker Street, Woodstock, NY 12498 845-679-4500 www.ipatools.com info@ipatools.com





### 90° Multi-Port Air Gun AIR COMB® #8050-8053

Special, multi-port nozzle maximizes air pressure and volume at a 90° angle to thoroughly clean air filters, condensors, radiators, and more.

- Focused, high-pressure output
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- Does not punch holes in air filters
- Available in four sizes



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Safe on All Air Filters





### FUSE SAVER® MASTER KIT #8016

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IPA® is a manufacturer of first time specialty tools and equipment with 24 hour repair/replace policy. All the products are available through local distribution. To learn more, visit www.ipatools.com or call 845-679-4500. ©2014 Innovative Products of America® Incorporated. All rights reserved.

# ORIGINAL EQUIPMENT FOR THE AFTERMARKET

here's no doubt about it:

Age requires a stronger prescription. Even OE replacement shocks may not be "good enough" for used vehicles.

### When OE Isn't Enough

OE shocks and struts are designed and built to work well on a brand new vehicle rather than one with 50,000 miles or more. As a vehicle and its tire control components age and wear, they allow more steering and suspension movements. When you think about it, replacing shocks and struts with OE units on a used vehicle can be like putting used parts back on the vehicle. OE shocks and struts are not designed to compensate for additional suspension wear or movements.

### Why are KYB Shocks and Struts a Better Choice for Used Vehicles?

Because they are calibrated to help compensate for age and miles driven. Shocks and struts main job is to control and resist movement. Since a used vehicle will have additional steering and suspension movements, they must be capable of at least or more than the original design if your goal is to restore original vehicle performance.

KYB is one of the world's largest suppliers of original equipment shocks and struts to new vehicle manufactur-



ers. KYB aftermarket shocks and struts are built with the same OE quality and on the same KYB OE assembly lines as our OE products. The only difference is re-calibrated damping rates to help compensate for typical wear.

The result: KYB shocks and struts help restore like-new ride and handling for used vehicles.

Restoring designed ride control performance, like 20/20 vision, requires OE-level manufacturing and aftermarket designed performance: KYB products have both!

KYB offers performance-restoring shocks and struts for almost every domestic and import vehicle on the road today.





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Original Equipment for the Aftermarket<sup>®</sup>



### **KYB Shocks & Struts**

Research, testing, zero-defect manufacturing tolerance and a commitment to original vehicle design and performance. The choice of New Vehicle Manufacturers and Top Service Professionals around the world.

Beware of Copies & Imitations

If it doesn't have the KYB logo - it's not KYB. Anything less than KYB......is just less!

# **SCAN TOOL CONSIDERATIONS**

iagnosing vehicles to get to the root problems of what needs to be repaired is one of the most frequent and time consuming challenges technicians face. The adage "time is money" certainly rings true when repairing vehicles. Fortunately diagnostic tools can help get repairs completed quickly and properly. This can translate into greater throughput of vehicles in and out of the shop, fewer comebacks, greater customer satisfaction, more repeat business, and a more efficient revenue stream. A scan tool can be a technician's best friend, but the choices of tools and what to look for can be daunting and confusing. There are certain features to look for that provide the desired return on investment (ROI).

A recent aftermarket study found that on average, technicians use a scan tool more than 30 times per week. Having a scan tool that could save four to five minutes per accurate diagnosis between providing VIN decode, DTC's, testing, proper diagnosis, resets, etc., would save 104-130 hours (or two to three or more average work weeks) per year. Wouldn't it be nice to put that extra time to use, repairing more vehicles and generating more revenue?

There are numerous tools on the market that provide a wide range of functionality. There are expensive OE specific tools, generic OBD-II, along with cheap counterfeits and many in between. To maximize your ROI from a single diagnostic scan tool, here are some things to consider:

**Speed:** If you can save a couple minutes per job, you can earn thousands of dollars more per year. Different tools use different hardware and software configurations. Just like some cars are faster than others and some computer microprocessors outpace the field, it is the same with scan tools. Differences in software architecture, data format, hardware, connection type, and more, all lend themselves to how the tool will perform. Consider the speed of the tool before you purchase.

Vehicle Coverage: Some shops need limited coverage for just one or a few vehicle makes. Others do not know what will be the next make to enter the bay. It could be domestic, Asian, or European, with countless years, models, and variants. Knowing your business and the vehicles repaired will impact your tool buying decisions.

**Functionality:** To do the job right, without outsourcing or referring customers elsewhere, the primary tool needs to be far enhanced beyond generic OBD-II reading. Proper functionality allows a deeper dive and has a better proper diagnosis success rate, which also translates into fewer expensive comebacks. Some of the functions to look for:



- Rapid VIN decode
- Standard and Special Tests
- Intelligent Vehicle Communication Interface (VCI) Communicate via lights and sound
- Wireless mobility like Bluetooth
- Output controls
- Resets
- Playback and Flight Recorder
- Seamless leap to online repair data
- Regular, rapidly downloaded updates
- Customer Reports Pull and print codes, data, graphs, etc. for your customers
- J-2534 Pass-Through for reprogramming
- History Data storage and retrieval for all scanned vehicles.

**Price:** Many scan tools cost \$3,000 to \$4,000 or more, depend on expensive hardware tablets, and annual or periodic updates are required. The hardware adds little value other than a place to view a screen and run the software. A lot of expense can be saved by going to a software-based solution that downloads to a tablet or laptop.

The MAHLE TechPRO Diagnostic Scan Tool was designed to meet the speed, coverage, functionality, and low price criteria mentioned above. Just announced at AAPEX 2014, it will be available in 2015.

MAHLE Aftermarket Inc., Service Solutions 10 Innovation Drive, York, PA 17402 USA Toll Free 800-468-2321 Phone 717-840-0678 www.servicesolutions.mahle.com

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### TECH TIPS

# IMPROVE ENGINE PERFORMANCE WITH GUMOUT MULTI-SYSTEM TUNE-UP

ore than likely, you've been asked, "Do I need to use a fuel additive or a fuel system cleaner?" and "Are they worth it?" A quick-and-easy answer is yes, but to make the best recommendation on which product to use, you need to understand the science behind the products.

Over time, all engines lose performance and fuel economy. Much of this is due to the impact of fuel on key engine parts. Even high-quality fuel produces carbon deposits during combustion. These deposits build up on engine parts, limiting their performance.

Fuel also contains ethanol, which attacks metal surfaces and allows water to have a more corrosive impact. Gumout<sup>®</sup> performance additives are developed with the latest science to maximize engine performance in these conditions.

Gumout's latest innovation, Multi-System Tune-Up<sup>®</sup>, treats the entire fuel system with an exclusive, scientifically formulated blend of premium cleaning and conditioning agents to restore performance and fuel economy in any engine type.

### A More Complete Clean

The intense heat of the combustion chamber can make important engine parts like piston tops and cylinder heads difficult to clean. While many fuel additives burn up before cleaning these hard-to-reach parts, the polyether-amine (PEA) used in Gumout remains stable, easily withstanding the  $495^{\circ}F$  heat.

PEA breaks the bonds between carbon deposits and engine parts, removing them from the fuel system. The result is cleaner piston tops and cylinder heads, as well as a cleaner combustion chamber. This reduces hot spots that can lead to pre-ignition and reduced combustion efficiency.

PEA also cleans other vital parts of the fuel system, such

#### **ITW Global Brands**

6925 Portwest Dr. Houston, TX 77024-8042 Toll-free: 855-888-1990 information@itwgb.com www.gumout.com as fuel injectors, intake valves and ports, for maximized performance and fuel economy. Once deposits have been removed, PEA bonds to the metal surface of engine parts to prevent future buildup.

### More Conditioning and Protection

But cleaning is only part of the story. Gumout Multi-System Tune-Up also features a wider range of conditioning ingredients. Antioxidants help stabilize fuel and oil, particularly in engines that are used less often, to keep varnish from developing on metal parts. In addition, corrosion inhibitors keep key engine parts from degrading, helping to extend engine life.

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

### Tested and Retested

We constantly put our formulas to the test — in the lab, on the track and on the street — to ensure they always meet the toughest standards of performance and safety.

Cleaner, better conditioned engine parts mean better performance. Prove it to yourself at GumoutProveIt.com.



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

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

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

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

Engine

¢÷0 C ---H 3-Ethanol H

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

100

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

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

SCIENCE IN. PERFORMANCE OUT."



## PINPOINT UNWANTED NOISES WITH SMARTEAR BY STEELMAN PRO

hen a customer brings in a car with unwanted noises what do you do? Some techs will use a screwdriver and put their ear up to it to find loose bearings. This is unsafe and not the optimal solution for finding noises. Smart Ear can pinpoint faulty fuel injectors, hone in on a bearing noise in an alternator, or find the source of a noise coming from anywhere in the chassis, just to name a few. There are some techs that will mistakenly fix a noise that the customer wasn't complaining about which wastes time and money.

Now there is a high-tech solution for finding and pinpointing squeaks, noises, and rattles anywhere within a vehicle. Smart Ear by Steelman PRO is designed to turn your smart phone or tablet into a state of the art sound detection device. Simply purchase the Smart Ear hardware, attach your smart phone or tablet to the Smart Ear hardware, download and initiate the app, and you are ready to start finding unwanted noises! With three different versions, Smart Ear Lite, Smart Ear 1, and Smart Ear 2, the technician can choose which model fits their needs.

Smart Ear Lite (91925) comes with a sound wand, aluminum probe, ear buds, and a dual port connector. This version is ideal for the technician wanting to use their smart device as a stethoscope. Sound output levels are displayed in digital or analog format and a sound wave graph is also shown. The aluminum probe attachment can help find loose bearings or vibrations coming from different components under the hood.

Smart Ear 1 (91927) comes with a sound wand, aluminum probe, one sound sensor clamp, ear buds, a dual port connector, and a dual port dongle. This version is great to use as a stethoscope, or the technician can use one of the sound sensor clamps to find noises. The clamp can be used to zero in on noises that are hard to reach or hear under the hood or chassis. The Smart Ear 1 app comes with an equalizer so the user can zero in on specific pitches and frequencies of noises. Applications include, but aren't limited to: finding fuel injector misfires, loose bearings in an AC compressor; or pinpointing noises in differentials, idler arms, or tie rods.

Smart Ear 2 (91929) comes with a sound wand, aluminum probe, six sound sensor clamps, Bluetooth wireless headphones, a docking station, and a wall charger for the docking station and headphones. Smart Ear 2 has several features within the software that enables the user to pinpoint nois-



es more accurately. The technician can name each clamp location within the app for ease of reference while testing. Diagnostic sound events can be recorded and emailed to other technicians to get a second opinion, or emailed to the customer to ensure the proper noise is being fixed. An equalizer within the sound settings can be used to hone in on specific noises as well.

SmartEar; JS Products Inc. 6445 Montessouri St., Las Vegas, NV 89113 P-800-255-7011 F-775-898-8773 www.steelmanpro.com.







WWW.STEELMANPRO.COM



# DIAGNOSING LOW BRAKE PEDAL

Problem: Low brake pedal

Vehicles affected: All cars and trucks Condition: Vehicle has had multiple master cylinders replaced

**Repair procedure:** Here at the Raybestos<sup>®</sup> brand Tech Service Line, we talk to hundreds of technicians a day and low pedal issues are one of the top 10 questions daily. A low brake pedal typically is caused by air in the hydraulics, mechanical failure, leaks or misadjustments. In the "old days," the master cylinder was the first part to be replaced as it was easy and inexpensive. On today's cars, not only are the parts more expensive, but so are labor hours. Diagnosing the problem quickly and accurately is more important than ever.

At the Raybestos brand Training Center, we have been teaching the theory "process of elimination" for quite some time. It starts out with installing approved brake hose clamps on all rubber hoses. Using the proper clamps will not harm the hose. After installing the clamps, start the vehicle and apply pedal pressure. If the brake pedal is good, then everything upstream of the clamps is good. Now, remove the clamps one at a time to determine the problem. Look for a bulging brake hose and leaks. If you determine that air in the system is the cause, tapping the caliper with a small hammer will help dislodge the trapped air. If the pedal was low with the clamps on, the problem is upstream.

Some ABS units have access holes to check for leaking accumulators, but many do not. Rather than guess which part to replace, try plugging the master cylinder ports with brass plugs to check the operation. With the plugs installed, start the vehicle and apply the brake. If the pedal slowly sinks, the master has internal issues. High hard pedal will usually confirm a good master cylinder. This is also a good way to bench bleed a new master before installing.

Every Raybestos brand Professional Grade master cylinder goes through rigorous testing before ever getting on the shelf. Every part manufactured is air tested and only high quality rubber compounds are used that meet SAE J1153 and J1154 standards.

For more information on bleeding and diagnosing brake problems, contact the Raybestos brand Tech Service Line at 800-323-0354.



Licensed to Brake Parts Inc from Affinia International Inc., the Raybestos brand has been known as the best in brakes for over 100 years. With a demonstrated commitment to research, development and testing, the Raybestos brand is widely recognized for quality brake components, including friction, rotors, drums, calipers and hydraulic products. The company was the first to introduce Enhanced Hybrid Technology (EHT<sup>TM</sup>) with its Element3<sup>TM</sup> brake pads, delivering the best attributes of ceramic and semi-metallic for optimal performance, improved pad wear and durability, and increased stopping power during aggressive braking. To learn more, visit www.raybestosbrakes.com.

Brake Parts Inc. 4400 Prime Parkway McHenry, IL 60050

#### ADVERTISEMENT



# MORE BRAKING CONTROL. LESS STATUS QUO.

![](_page_124_Picture_2.jpeg)

### INTRODUCING THE WORLD'S FIRST ENHANCED HYBRID BRAKE PAD.

![](_page_124_Picture_4.jpeg)

It's time to forget everything you know about friction formulations. Element3<sup>™</sup> with Enhanced Hybrid Technology<sup>™</sup> (EHT) delivers the best attributes of ceramic and semi-metallic all in one pad. This innovative engineering breakthrough ensures unsurpassed stopping power and vehicle control,

even under the most aggressive braking conditions. Get ready for unprecedented braking control. Only with Element3.

#### www.element3eht.com 800-323-0354

![](_page_124_Picture_8.jpeg)

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![](_page_124_Picture_10.jpeg)

AUTOMOTIVE BRAKE PADS

# SKF EXPLAINS CORRECT TORQUING PROCEDURE FOR FRONT WHEEL HUB UNITS

id you know one of the leading causes of premature hub failure is improper torquing of the axle nut? Axle nuts need to be torqued to the correct specifications to ensure the performance and longevity of the hub. Under torque of an axle nut allows excessive movement, causing uneven loading and excessive wear. Over torque of the axle nut causes excessive load, which causes the bearing to overheat (one of the most common causes for failures).

To guarantee everything is torqued correctly, follow the manufacturer's installation procedure. Ignoring these important details will reduce the life of components.

Correct torque specifications are available from a number of sources including SKF's Torque Specification Guide (Form #457377). This guide contains torque specifications and procedures for properly securing all domestic and import wheel bearing units. Torque specifications can also be found in SKF's online catalog in the Application listing section.

Torque specifications are designed to set the preload of the bearing. The preload of the bearing is very important to the length of time that a bearing will last.

When installing a hub, torquing of the axle nut is the final procedure and a very critical part of the installation process. Most drive axle hubs have a center nut that must be torqued down onto the axle shaft to a specific torque value. Putting the proper torque on the center nut sets the preload for the bearing and keeps the bearing form separating while in operation.

Some hubs come with a new nut in the box. This typically occurs when a one-time use self-staking nut secures the hub. In these applications, a new nut must always be used when installing a hub. Reuse of the old nut could potentially cause the nut to loosen during vehicle operation.

Remember: Many vehicles require the wheels to be on the ground for final torquing to OEM specifications. This assures the proper mating of the split inner rings of the bearing needed to achieve the proper internal clearance.

For specific mounting instructions, refer to the vehicle manufacturer's service manual for that model.

### Interested in additional technical information?

SKF helps technicians stay informed through social media with the SKF Parts Info Twitter page and YouTube channel. Follow us on Twitter @skfpartsinfo or subscribe to our YouTube channel www.skfpartsinfo.tv and access the lat-

![](_page_125_Picture_13.jpeg)

est training and installation videos, technical tips and product information 24/7!

Another way to obtain technical information is to book an SKF training truck at your location. Staffed by ASE Master-Certified technicians, SKF training trucks consist of a mobile classroom complete with hands-on training demos, detailed product cutaways of SKF premium hub bearings, technical tips, videos and more. They are also designed to teach you how to educate customers about the differences between SKF products and competitor components. Contact your local SKF representative for details.

For more information about SKF, contact your local SKF representative, visit **www.vsm.skf.com**, call 800-882-0008 or visit the SKF e-catalog at **www.SKFpartsinfo.com**.

> SKF 890 North State Street Suite 200 Elgin, IL 60123 www.skf.com

![](_page_125_Picture_18.jpeg)

# Knowledge in.

SKF is committed to manufacturing premium wheel hub bearings that you can install with absolute confidence, knowing that they typically last 3-4 times as long as value grade hubs. So we put over a century of bearing knowledge and manufacturing experience into every wheel hub bearing we make.

# Knowledge out.

-----

Hub unit

We're also committed to supporting the technicians who install our products. So our SKF training trucks - mobile classrooms staffed by ASE Master-Certified technicians – are on the road every day, in every part of the country. Providing engineering knowledge. Sharing technical tips. And equipping you with the knowledge you need to sell the benefits of OE quality fit, form and function.

Protect your reputation – and your customers. Learn more at www.vsm.skf.com or join the discussion at the sites below.

You Tube www.skfpartsinfo.tv 🔰 @skfpartsinfo

![](_page_126_Picture_7.jpeg)

### Visit us at AAPEX Booth #4650!

![](_page_126_Picture_9.jpeg)

![](_page_126_Picture_10.jpeg)

![](_page_126_Picture_11.jpeg)

#### The Power of Knowledge Engineering

![](_page_126_Picture_14.jpeg)

# **CUTTING DOWN HEAT** WITH TECHSMART

he Ford 6.0L Power Stroke engine is one of the most popular and controversial diesel engines of the past couple decades. Ford partnered with International to produce the engine for model years 2010-03 for various F Series pickups. E Series vans. Excursions and a number of International medium-duty applications. While the engine was packed with power and torque, it is also known for having

its share of electrical and mechanical gremlins. The fuel system on 6.0L engines uti-

lizes a HEUI or hydraulic electronic unit

injection injector coupled with a high pressure oil pump to generate injection pressures of over 26,000 PSI. Each injector has two 48-volt 20-amp solenoids that control the spool valve position within the injector to regulate the duration and timing of the fuel injection. Each solenoid requires a consistent 48v supplied to it by the Fuel Injection Control Module, commonly known as the FICM. When voltage drops or the FICM begins to malfunction, the solenoids cannot regulate the spool valve position properly, causing hard starting, reduced engine power, a rough running engine, excessive exhaust smoke and/or stalling.

Often, when injectors are replaced, the original FICM is overlooked. The previous faulty injectors may have damaged the FICM. If the FICM is no longer supplying 48 volts, it may cause a repeat failure to the new injectors. It is suggested that you replace the FICM when replacing a full set of injectors. Originally the only option for this repair was to purchase a new FICM from the dealer that required a reflash. Recently, there have been additional options such as the half shell, but you're stilling buying more than you need. TechSmart<sup>®</sup> by SMP now offers a drop-in replacement power board that can be installed on any 6.0L FICM and does not require a re-flash. Their field driven solution is to supply you with the just the part that failed. This significantly cuts down on the repair cost over replacing the

Designed on the control of the second test of test

SMP's engineers took the leading competitor's FICM power board and compared it to the TechSmart R76001 under a FLIR (infrared) camera to see how the board would hold up on cold start. After one minute of load, the critical time when electronics rapidly heat up, the TechSmart unit was still blue-green on the FLIR camera, indicating the redesigned circuit board and high quality components are doing their job of cutting down on heat. The resistors on the competitors unit are glowing bright red, which means the excessive heat is building up due to poor circuit design, potentially causing long term damage.

Each redesigned TechSmart unit comes with simple instructions in the box to replace just the malfunctioning power board. The TechSmart R76001 FICM power board truly takes a known problem and comes up with a clever, well-designed and cost-effective "Made in the USA" solution.

www.techsmartparts.com

# If it's not a perfect clone, who knows how it will perform?

![](_page_128_Picture_1.jpeg)

![](_page_128_Picture_2.jpeg)

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

![](_page_128_Picture_4.jpeg)

### The right match...every time.

Product names, logos, brands, vehicle makes/models and other trademarks featured or referred to are the property of their respective trademark holders. These trademark holders are not affiliated with Standard Motor Products, Inc., or our products. Total vehicle coverage is based on registered vehicle population in the United States as reported by Experian.

![](_page_128_Picture_7.jpeg)

standardbrand.com

# FIND AND FIX THOSE HIDDEN PROBLEMS FASTER

hen that tricky vehicle rolls into your bay, sometimes it can feel like a game of hide and seek. The problem is hiding and you must seek out the right diagnosis and solution. Wouldn't it be nice to have a few clues to get you going in the right direction?

What if you knew the top 10 most common component failures, diagnostic trouble codes (DTCs), symptoms and lookups for that challenging vehicle — before you even begin your diagnostic process? Unless the vehicle is a really unique case, chances are very good that something in those lists will ring a bell and give you a jumpstart toward the correct diagnosis and solution.

These "Top 10" lists are the latest enhancement to the exclusive 1Search<sup>™</sup> technology in ProDemand<sup>®</sup> that brings together complete OEM repair data with the expert-based knowledge in SureTrack<sup>®</sup>. SureTrack is powered by millions of actual repair orders that add valuable real-world insight to the diagnostic process. So technicians can quickly get a full picture of the most likely issues with the vehicle and complete the repair more accurately and efficiently.

In three simple steps, ProDemand guides the technician to a likely cause of the vehicle issue. Here's how it works:

**1.** Select your vehicle including year, make, model and engine. Before you've even typed in your search item, 1Search immediately delivers a dashboard with the top component failures, codes and symptoms, along with the most common lookups that technicians enter for that vehicle.

**2.** Review the lists and click any items that seem applicable (in many cases you will find the correct solution without even having to use the search bar).

**3.** The results page delivers a link to the related OEM information and a list of SureTrack Real Fixes that have solved the specific issue for other technicians. Alongside the Real Fixes you can see the number of times the vehicle has been repaired correctly as a result of using that fix.

Let's take a closer look, using a 1998 Chevrolet Malibu with a 3.1 liter engine as an example (see the graphic). Once you have selected the vehicle, you see that disc brake pad is the most commonly replaced part on this car (for 7,274 repairs), followed by brake rotor, engine water pump and battery. If none of those seem like a fit, you can also see the most common symptoms ("Engine Does Not Start" is number one based on 1,132 repairs) and the most common codes (P0300 is number one based on 285 repairs).

_	_					PRODUMA
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		Search Enter Co	odes, Cor	mponents or Symptoms	<u>۵</u>	
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COMPONENTS		DTCs		SYMPTOMS	LOOKUPS	-
Disc Brake Pad	7374	1. P0300: Random	285	1. Engine Does No., 1132	1. Wiring System	
2 Brake Rotor	6149	2. PO440: Evapora	150	2. Coolant Leaks F., 1094	2 Anti-Theft/Lock	
Engine Water P.	3808	3. P0341: Camsha	129	3 Noise Heard Fro. 537	3 Engine Intake M.	
Battery	3558	4 P0442 Evapora	84	4 Abs Light On 445	4 Powertrain Cont	
5 Intake Manifold	3368	5. P0401: Exhaust	52	5. Engine Overheats 310	5 Transmission FL.	-
Fuel Filter	3336	6. P0141: 02 Sen	47	6. Noise Heard 289	6. Radio	
7. Alternator	3293	7, P1404	46	7, Fluid Leaks Fro. 257	7. Ignition Switch	

In our example we'll assume that you have a P0300 code and click that item on the DTC list. You now can select OEM repair information including descriptions and procedures, or Real Fixes with titles like, "Replaced Spark Plugs," "Replaced Fuel Injector," and "Replaced Fuel Filter." Select any of those and this is where SureTrack delivers insight from thousands of professional technicians, including:

- Detailed parts replacement records
- Repair timesavers and tips
- Guided component tests with connector views
- Extensive waveform & PID graph library
- Interactive community of professional technicians

With that information right at hand, you can confirm the diagnosis, complete the repair and get the vehicle back on the road for your customer. Having visibility to the most common problems and lookups for the vehicle from the very beginning enabled you to get to the solution quickly, without even having to search. No more hide and seek – now it's all about finding the answers in the most efficient and accurate way possible.

For more information, visit www.mitchell1.com.

![](_page_129_Picture_20.jpeg)

## TOYOTA PRIUS AND HYBRID DRIVE SYSTEMS TRAINING

ORLDPAC Training Institute (WTI) has developed a highly regarded Toyota Prius and Hybrid Drive Systems class for skilled technicians and forwardthinking independent repair shop owners seeking to expand service offerings to include hybrid vehicle technology.

Benefits of offering hybrid vehicle service include increased ROs and profits associated with a growing population of hybrid vehicles, differentiation from competitors, and an overall increase in positive customer perception as a result of differentiating the business as a high-technology vehicle repair solution.

### Over 1.5 million Toyota Prius Hybrids sold in the USA!

WTI's Toyota Prius and Hybrid Drive Systems class offers advancedlevel training that equips attendees

with the knowledge and know-how to service the Toyota Prius as well as hybrid models such as the Nissan Altima and Ford Focus since these vehicles are manufactured using licensed Toyota hybrid technology. Attendees also obtain elaborate materials and hands-on guidance to ensure skills learned in the classroom can immediately be put into practice back at the shop.

For example, attendees learn how crank no-start problems can be challenging when dealing with a hybrid vehicle's highvoltage (HV) battery because the electrical system is completely different than non-hybrid vehicles. This makes troubleshooting a challenge. It is not uncommon to be doing routine maintenance on a Generation 1 Prius (2001-2003) only to end up with an engine that cranks but will not start. Something as simple as overfilling the crankcase with engine oil can cause a no-start situation because they only hold 3.9 quarts of oil; four is too much. Or when changing the air filter, a small piece of

### TOPICS COVERED

- Serial-parallel hybrid drive operation and diagnosis
- HV battery & inverter diagnostics and service procedures
- Inverter and transaxle cooling system service and common issues
- High-Voltage Electronic AC system operation
- Electronic power Steering (EPS) common issues
- Electronic Controlled Regenerative Braking System
- Transaxle operation and service procedures
  Engine operation Atkinson cycle and fuel delivery
- strategies
  Zero leak standard EVAP system operation and
- diagnostics
  Gen 1, Gen 2, and Gen 3 overview of changes and features-Common issues, diagnostics, and repair

debris can easily get lodged over the mass air flow (MAF) sensor and keep the engine from running. As well, dirty throttle bodies

![](_page_130_Picture_20.jpeg)

are common due to the variable valve timing engine design. Any of these scenarios on a Gen I Prius may result in codes P3190, P3191 and P3101. These codes let you know the engine cranked but did not start. Unfortunately, because of the interdependent relationship of these codes, using standard troubleshooting techniques to isolate the problem may compromise your ability to do so

The problem is that the engine cranks using the electric motor called MG1 and the HV battery. It spins more than 800 to 1200 rpms for several seconds and it is difficult to tell the difference between the engine cranking and the engine idling. Once the codes are set you cannot crank the engine again until the HV computer is cleared. Then, depending on the battery condition, you may only get a few cranks before it sets a low State of Charge condition code and disables the HV system all together. If the HV battery gets low, you are dead in the water with no foreseeable way to recharge — meaning misdiagnosing the vehicle can quickly become be an expensive and timely proposition.

The majority of major issues that can arise when dealing with these codes can be avoided by following a few simple steps. When diagnosing this problem,

#### WORLDPAC Inc.

37137 Hickory St. Newark, CA 94560-5522 800-888-9982 ext. 5470

check the oil level and drain some out if questionable, clean the throttle plate if dirty, clean the MAF sensor element, and check the codes and freeze-frame data in the HV ECU for the P3101.

All WORLDPAC Training Institute (WTI) classes are created explicitly for the independent shop and are designed and taught by experienced professional automotive instructors. Learn more about the WTI, as well as Toyota Prius and Hybrid Drive System class dates and locations at www.worldpac.com/wti-prius.

![](_page_130_Picture_28.jpeg)

![](_page_131_Picture_0.jpeg)

### the latest products & TECHNOLOGIES TO HELP YOU WORK SMARTER AND KEEP YOUR SHOP PROFITABLE

![](_page_131_Picture_2.jpeg)

### **ENGINE TREATMENT**

Gumout Multi-System Tune-Up is the most advanced engine treatment technology available today, the company says. The versatile treatment is the only multi-system additive that can treat the complete fuel system in any engine type. Designed for today's engines, it is formulated with a special blend of premium cleaning agents, anti-oxidants and corrosion inhibitors that can be used in the fuel tank, crank case or directly in the fuel rail. This powerful new treatment is proven in ASTM test to improve performance when used in gasoline, diesel, biodiesel, E85 and motor oil.

For more information, visit www.rainx.com. ITW Global Brands/Rain-X

### **DIESEL FUEL PREP AND ENGINE OIL TREATMENT**

The Penray Companies, Inc. has introduced two new products that will help owners of diesel-powered cars and light trucks optimize the performance and economy of their vehicles — Penray Plus Diesel Fuel Prep and Penray Plus Engine Oil Treatment. Penray Plus Diesel Fuel Prep is a technology Penray originally developed for heavy-duty diesel engines. This diesel fuel treatment is engineered to keep fuel systems free of deposits and contaminants that can compromise the performance of fuel injectors and other fuel system components, all of which are manufactured to extremely tight tolerances for diesel applications. Keeping injectors clean will minimize plugging of diesel particulate filters (DPF), thus extending the life of the emissions control system. Another key feature of this new Fuel Prep is the ability to significantly raise the cetane rating of the fuel. Higher cetane numbers accelerate the combustion process to guarantee that the fuel burns where and when it is supposed to for maximum power and efficiency. In today's modern electronic fuel injection systems, combustion timing is more critical than ever. The new Penray Plus Diesel Fuel Prep helps to reduce maintenance costs and maintain efficiency by keeping the system clean and ensuring that consistent power and performance are preserved, according to the manufacturer.

![](_page_131_Picture_8.jpeg)

For more information, visit www.penray.com Penray

![](_page_131_Picture_10.jpeg)

#### **OIL FOR BMW**

LIQUI MOLY has introduced a new type of oil especially for BMW. The Special Tec LL 5W-30 was developed especially for models requiring oil complying to the BMW Longlife-01 standard, including the newer M-class. Special Tec LL 5W-30 has been officially approved by BMW. It is distinguished by even better lubricating properties. This saves fuel and increases engine life. This fully synthetic oil satisfies the specifications for the M-class. It does not carry a BMW approval because automobile manufacturers have not issued approvals for oils in the 60 viscosity class for some time, the company notes. Nevertheless it is still the right oil for many high performance engines such as those in the old M-class.

For more information, visit www.liqui-moly.de. LIQUI MOLY

#### **MICRO ELECTRIC ETHANOL FUEL PUMP**

Mr. Gasket made available its new Micro Electric Ethanol Fuel Pump. The new Micro Electric Ethanol Fuel Pump is compatible for use with E85 fuel, ethanol and methanol. Its self-priming pump and simple two-wire design are lightweight and ideal for carbureted vehicles needing consistent and reliable fuel pressure regardless of the type of driving, according to the maker. The new 12E pump also is good for transferring fuel between tanks. This pump is rated to flow 35 gallons per hour at 4-7 PSI, and is compatible with all 12-volt negative ground systems.

For more information, visit www.accel-ignition.com. Accel/Prestolite/Mallory/Mr. Gasket

![](_page_131_Picture_17.jpeg)

### LOW PROFILE SERIES FANS

A variety of Champion Low Profile Series fans are available from MARADYNE High Performance Fans for Jeeps owners to increase engine cooling capability, horsepower and A/C cooling at idle. Available in 7-inch to 16-inch fan sizes — all with a depth of 3.19 inches or less — the Champion Series offers a low profile, pushpull fan in a quiet, reversible

![](_page_132_Picture_3.jpeg)

S-blade design that eliminates vibration contact and increases airflow, the company says. The fans feature sealed motors that are IP68-certified dustproof and waterproof. MARADYNE fans are made from all glass-filled nylon construction and feature concentric rings that prevent the blades from flexing as they achieve maximum rpm. They are dynamically balanced at the factory for smooth running, less noise and having a long motor life. The Champion Low Profile Series 16-inch fan (part No. M162K) is the company's most popular fan option, featuring a 225 watt heavy duty motor that delivers 2,170 cubic feet per minute (CFM) with an amp draw of 18.0.

#### www.maradyne.com

Maradyne High Performance Fans

#### **REPLACEMENT BULBS**

PIAA Corporation has broadened its line of advanced-technology Night-Tech replacement bulbs with the addition of 9007 and H13 bulbs to its already comprehensive offerings of bulbs using this technology. These new SAE/DOT-compliant 9007 and H13 halogen bulbs fit a wide variety of domestic and import vehicles, so now even more motorists will get to enjoy the enhanced visibility provided by Night-Tech science, the company states. The advanced technology behind PIAA Night-Tech bulbs includes special materials and manufacturing, giving these bulbs the ability to provide up to 90 percent more

![](_page_132_Picture_9.jpeg)

light than conventional bulbs. This translates into an increase in illumination range of as much as a hundred feet/35 meters compared with conventional bulbs. And new-generation manufacturing and QC processes make Night-Tech bulbs more durable and longer-lasting than other designs.

*www.piaa.com* PIAA-USA Corporation

#### REAR SUSPENSION

2014 Ram ProMaster owners now have an easy-to-install option for enhancing the vehicle's rear suspension. SuperSprings International has developed a new SumoSprings

![](_page_132_Picture_14.jpeg)

mpstop Rear SumaSpring SSR-304 Installed

Solo "airless airbag" application designed specifically for the popular cargo van. The SumoSprings Solo is a one-piece unit composed of a proprietary microcellular urethane that fills the gap left by a short factory bump stop. SumoSprings improve ride, reduce sideto-side body roll and eliminate sudden bottoming out, the company reports. They offer a progressive spring rate that provides full support when needed, while also engaging smoothly. SumoSprings can be installed in-house with standard tools.

*www.supersprings.com* SuperSprings International

### WATER PUMP PLIERS

![](_page_132_Picture_19.jpeg)

KNIPEX Tools LP adds the Alligator XL (No. 88 01 400) to its Alligator water pump pliers family. The new, larger size pliers offers the performance and comfort of water pump pliers, while being lighter in weight and having a greater gripping capacity than comparable pipe wrenches, the manufacturer says. The 16-inch Alligator XL is distinguished by a forged box-joint design for very high stability, providing a true top and bottom grip that makes for quick and comfortable use. The Alligator XL self-locks on pipes and nuts, providing for no slipping off the work piece and requiring low hand force. The Alligator XL has a thin head and joint area making it great to fit into tight, hard-to-reach places. Gripping surfaces, designed to grip all shapes of work pieces, with special, hardened teeth of approximately 61 Rockwell hardness, contribute to the tremendous gripping ability of the Alligator XL pliers and minimize wear on both the pliers and the work piece.

*www.knipex-tools.com* Knipex Tools

#### FULLY RUGGED NOTEBOOK

GammaTech debuts its latest fully rugged notebook, the DURABOOK R8300, for mobile professionals who are looking for a cost-effective computing solution. Built rugged for harsh and demanding outdoor applications, the DURABOOK R8300 exceeds or meets the most difficult environmental speci-

![](_page_132_Picture_24.jpeg)

fications, which include MIL-STD 810G for shock, drop, vibration and temperature, IP65 for water and dust resistance, MIL-STD 461F, ANSI/ISA 12.12.01 and ATEX Zone 2 for operation in hazardous locations. The company says the DURABOOK R8300 comes with enriched features such as a large 13.3-inch TFT touch screen LCD display to allow direct-sunlight readability, an Intel third generation i-Core LV/ULV CPU i-Core i7-3555LE or i-Core i5-3437U mobile processor which provides optimum power consumption, weight and performance, Intel QM77 Express Chipset, Intel AMT8.0, Intel Rapid Storage Technology with RAID support, Intel Smart Response Technology and Intel Anti-Theft Technology.

www.gammatechusa.com

GammaTech Computer Corp.

![](_page_132_Picture_28.jpeg)

#### **AUTOMOTIVE PRODUCTS GUIDE**

#### THE PLATINUM NAPA FILTER

NAPA's Platinum filter offers technology for the latest advancements in synthetic oil and performance oil filters. Featuring a host of oil filter innovations, including wirereinforced, fully synthetic media, ultra-durable hydrogenated nitrile compound antidrain back valve (where applicable), this oil filter provides the ultimate protection in

APG

![](_page_133_Picture_4.jpeg)

the NAPA family of oil filters. Visit www.napafilters.com for more information.

NAPA

#### POWERFUL ENHANCEMENTS TO HUNTER'S POPULAR TC3700 TIRE CHANGER

Hunter's new generation TC3700 tire changer now features a polymer mount/ demount head that resists damage to rims. The new mount/demount head also locks vertically for increased wheel face protection. The TC3700 features an exclusive bead roller system that performs all bead loosening from an upright position. The enhanced TC3700 is great

![](_page_133_Picture_9.jpeg)

Hunter Engineering

for wide and heavy tires, and improves performance on plastic clad and raised spoke wheels.

#### AUTOMATIC LEVERLESS TIRE CHANGER

The new R80DTXF tire changer features an automatic bead lifter, variable speed turntable and bilateral bead loosener with direct hand-operated controls. It also offers a traveling drop-center tool, top bead assist rollers, dual lower bead lifting discs and a nylon non-marring wheel restraint

![](_page_133_Picture_13.jpeg)

device. A 31-inch capacity turntable with adjustable hardenedsteel RimGuard wheel clamps helps shops broaden their service range. Visit www.rangerproducts.com for details.

Ranger Products, a division of BendPak Inc.

#### TRICO SENTRY HYBRID WIPER BLADE

![](_page_133_Picture_17.jpeg)

Designed for Maximum Visibility Engineered with Dual-Shield hybrid technology, the TRICO Sentry wiper blade includes a spring steel-beam structure for better windshield pressure and the side-mount design provides a lower profile for improved windlift. Available in lengths from 14 to 28 inches, TRICO Sentry is equipped with the SWIFT easy-connect system for quick installation. For additional information, please visit www.tricoproducts.com/sentry.

TRICO

#### TOUGHONE ABSORBENT GLASS MAT BATTERIES

ToughOne Absorbent Glass Mat (AGM) batteries, available exclusively from Advance Professional, provide superior performance in vehicles with multiple electronic devices, and deliver up to 70 percent

![](_page_133_Picture_22.jpeg)

better electrical flow and twice the battery life of a standard battery. For more information and the latest promotions on ToughOne products, call your local Advance delivery location.

Advance Auto Parts Professional

#### WORLD BRAKE RESOURCES (WBR) WORLD BRAKE

RESOURCES (WBR) is a complete braking solution for

![](_page_133_Picture_27.jpeg)

Asian, domestic and European vehicles. Products include WBR brake rotors with Run True™ Technology, WBR Dual-Technology 100 percent copper free metallic brake pads with high heat formulation, WBR Dual-Technology ceramic brake pads with low noise and low dust formulation, WBR complete disc brake hardware kits and WBR Premium and Premium OptiSelect calipers remanufactured to match exact OE specifications. WBR products offer professional quality with proven performance and are available exclusively at WORLDPAC. www.wbrautoparts.com

WORLDPAC

#### COMPLETE BRAKE OFFERING

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

![](_page_133_Picture_32.jpeg)

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

#### WALKER PRODUCTS HAS ADVANCEMENT IN ENGINE MANAGEMENT SENSORS

A full service kit from Walker Exhaust contains not only the base sensor, but also provides the technician

![](_page_133_Picture_37.jpeg)

and DIY'er with the mating connector and pigtail including the butt splices and heatshrink to ensure a watertight connection. We are initially offering 238 SKUs in the following key product categories: throttle position sensor, intake air temperature sensor, engine coolant temperature sensor, idle air control motor, manifold absolute pressure sensor, camshaft/crankshaft position sensor and vehicle speed sensors.

Walker Exhaust

### 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.

![](_page_134_Picture_3.jpeg)

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August 2014

- 12. Does Not Apply
- 13. Publication Title: Motor Age
- 14. Issue Date for Circulation Data Below:
- 15. Extent and Nature of Circulation

	Average No. Copies Each Issue During Preceding 12 Months	No. Copies of Single Issue Published Nearest to Filing Date
A. Total Number of Copies	113,158	112,214
B. Legitimate Paid and/or Requested Distribution		
1. Outside County Paid/Requested Mail Subscriptions Stated on PS Form 3541	102,518	104,554
2. In-County Paid/Requested Mail Subscriptions Stated on PS Form 3541	0	0
<ol> <li>Sales Through Dealers and Carriers, Street Vendors, Counter Sales, and Other Paid or Requested Distribution Outside USPS</li> </ol>	61	78
4. Requested Copies Distributed by Other Mail Classes Through the USPS	0	0
C. Total Paid and /or Requested Circulation (Sum of 15b (1), (2), (3), and (4))	102,579	104,632
D. Non-requested Distribution		
1. Outside County Non-requested Copies Stated on PS Form 3541	9,543	7,098
2. In-County Non-requested Copies Stated on PS Form 3541	0	0
3. Non-requested Copies Distributed Through the USPS by Other Classes of Mail	0	0
4. Non-requested Copies Distributed Outside the Mail	544	423
E. Total Non-requested Distribution (Sum of 15d (1), (2), (3) and (4))	10,087	7,521
F. Total Distribution (Sum of 15c and e)	112,666	112,153
G. Copies not Distributed	492	61
H. Total (Sum of 15f and g)	113,158	112,214
I. Percent Paid and/or Requested Circulation	91.05%	93.29%

- 16. Electronic Copy Circulation
  - \*If you are not claiming electronic copies, skip to line 17
  - A. Requested and Paid Electronic Copies
  - B. Total Requested and Paid Print Copies (Line 15C) + Requested/Paid Electronic Copies
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  - I certify that 50% of all my distributed copies (electronic and print) are legitimate requests or paid copies.

17. Publication of Statement of Ownership for a Requester Publication is required and will be printed in the November issue of this publication. Name and Title of Editor, Publisher, Business Manager, or Owner: Kristina Bildeaux, Audience Development Director

Signature:

Kustina Bildeaus

Date: 09/30/14 I CERTIFY THAT THE STATEMENTS MADE BY ME ABOVE ARE CORRECT AND COMPLETE.

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### **TOOLS & EQUIPMENT**

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[THE TRAINER]

### **AIR FILTER SERVICE** WHEN WAS THE LAST TIME YOU CHECKED YOUR CUSTOMERS' CRITICAL FILTERS?

### BY PETE MEIER Technical Editor

Back in the days of carbureted engines, it was fairly easy to tell when an air filter needed to be replaced. Clogged filters acted just like the manual choke plate, enriching the air/fuel mixture and eventually fouling spark plugs. Checking them routinely was easy, too, considering that tune-ups typically were spaced at 15,000-mile intervals and we had to remove the air cleaner assembly to access the carburetor adjustments.

While the impact of restricted airflow might not be as great as it was in those "good old days," the air filter is still a critical part of the air induction system. Restricted air filters still can lead to fuel trim shifts that might break the failure limits and result in Diagnostic Trouble Codes (DTCs). Worn filtration media might break off and enter the engine, contaminating the Mass Air Flow sensor or worse. Damaged seals can allow destructive contaminants into the engine and accelerate wear on the piston and cylinder walls, and those same contaminants also can make their way down into the oil supply, turning it into an abrasive cleanser that will damage bearing surfaces and internal components.

Knowing when to recommend replacement is an uncomplicated task. If the filter design allows you to spread

mann

![](_page_139_Picture_6.jpeg)

the elements and inspect for debris build-up, a simple visual inspection will tell you all you need to know. Many techs use the "floor drop" method to judge the air filter's health. Look for dirt to be visible on the floor when the filter is dropped from waist height, and even if the filter looks new, recommend replacement. Mileage intervals also typically are listed in the owner's manual and can be used to recommend replacement to your customer. If they live in a dustier environment or travel a lot on dirt roads, use the severe mileage/time recommendations for replacement (and any other services that are outlined by the maintenance schedule).

The Trainer is our monthly how-to video, providing technical information

for all levels of technicians. If you have a topic you'd like us to address in The Trainer, send an email to Pete Meier at pmeier@advanstar.com. 702

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