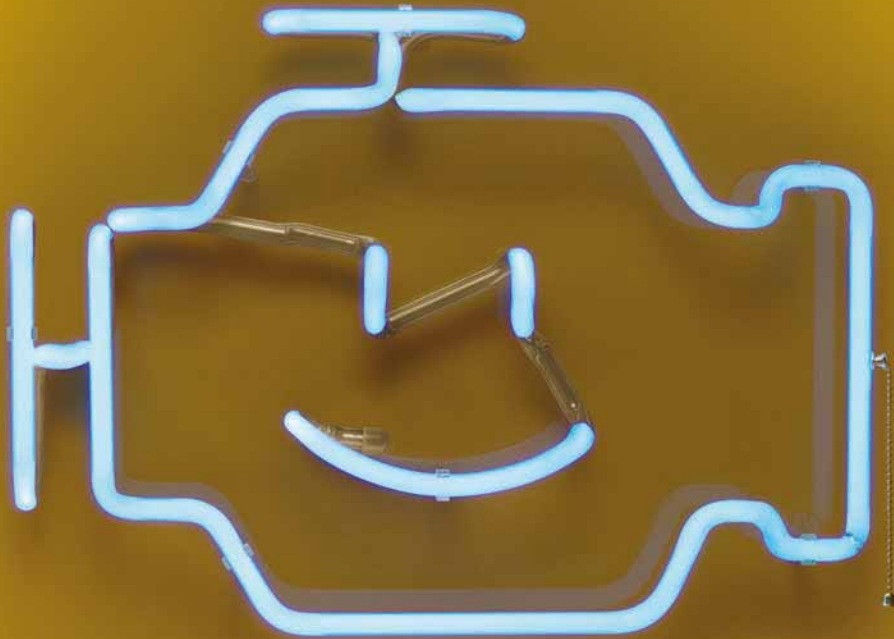


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Vol. 132, No. 11

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FLUSHING MORE THAN FLUIDS

Motor oil invoicing and you; what you need to know and consider.

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The resources employees would have access to outweigh your fears of losing their focus.



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TRENDING LESSONS IN READING LABELS

Deciphering labels kicked off ASRW's Mechanical Forum.



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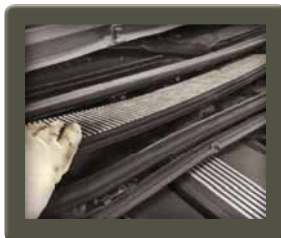
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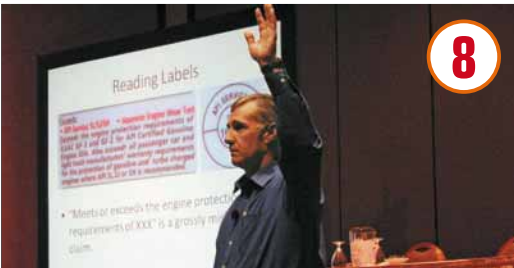
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Several Federated members have begun collecting toys and hosting events for Toys for Tots.

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NORTHWOOD AUTO SHOW CRUISES THROUGH 50 YEARS

The three-day event provided an opportunity for 60,000 visitors to see 500-plus product offerings.

»» MOTORAGE.COM/AUTOSHOW

FEDERAL-MOGUL, WAGNER LEAD SHIFT IN BRAKING

More than 1 million new 2014 vehicles will be equipped with Eco-Friction™ pads.

»» MOTORAGE.COM/BRAKESHIFT

TIMKEN TO CREATE TWO STAND-ALONE COMPANIES

The company is pursuing a separation of its steel and bearings and power transmission businesses.

»» AFTERMARKETBUSINESS.COM/TIMKEN2

GM ROLLS OUT NEW PARTS INITIATIVE

The initiative will increase inventories of select parts at dealer service departments.

»» AFTERMARKETBUSINESS.COM/GMPARTS

THE RISKS OF RECONDITIONED WHEELS

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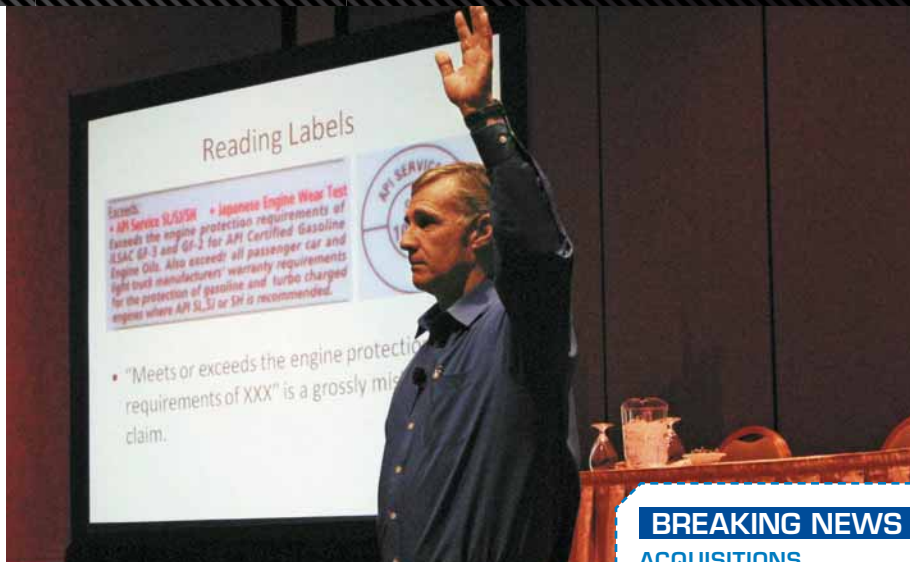
The Certified Automotive Parts Association has certified nearly 62 million parts as of September.

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Kevin McCartney leads the ASRW 2013 Mechanical Forum with a lesson on reading motor oil labels.

ASRW

Reading label lessons

Walking through how to read today's oil labels and decipher what chemicals truly are best for your customers' engines, Kevin McCartney says almost is like going through the five stages of grief.

You'll start with denial and by the end, be bargaining to just find out what oil to use, he jokingly told ASRW 2013 attendees during the event's opening session and Mechanical Forum. In condensing his four-plus hour class into one hour, McCartney, owner of Automotive Support Services, started off "The Hidden Liability and Opportunities in Fluids and Lubricants" with a case study of a low-mileage Nissan transmission with a known good service record that was serviced for a regular customer.

You have to become good at reading product sheets and labels, McCartney explains. ILSAC does not define its standard as a single engine requirement; it's an umbrella. Therefore, you have to learn to interpret what the product sheet and labels are saying.

For example, a brand will say, there are 32 areas and we'll call the ones we passed engine protections of the standard and the ones we failed, we'll call something else, he adds. But is it really approved? An example label McCartney shared claims only to meet the engine protection requirements of ILSAC. The same claim often was made about GM 4718M. Such products typically fail viscosity, fuel efficiency or SAPS limits that compromise oil life, deposits, cooling and even engine protection.

— *Tschanen Brandyberry, managing editor*

BREAKING NEWS ACQUISITIONS

ADVANCE TO BUY GENERAL PARTS

Advance Auto Parts has entered into a definitive agreement to acquire General Parts International Inc., (GPII), a privately held distributor and supplier of OE and aftermarket replacement products for commercial markets operating under the CARQUEST and WORLDPAC brands, in an all-cash transaction with an enterprise value of \$2.04 billion. The boards of directors for both companies have approved the transaction, which is expected to close in late 2013 or early 2014.

The deal will create the largest automotive aftermarket parts provider in North America, with annual sales of more than \$9.2 billion and more than 70,000 employees. The combined financial profile allows for an all-cash transaction and supports Advance's com-

[Advance] CONTINUES / PAGE 10

Discussion is on-going in MotorAge.com forums

Photo: Tschanen Brandyberry

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[Advance]

CONTINUED FROM PAGE 8

mitment to maintain its investment grade rating. Advance notes the acquisition will accelerate its growth strategy and enhance shareholder value.

Darren Jackson, CEO of Advance Auto Parts, said O. Temple Sloan III, president of General Parts International, will continue as president of GPII, reporting to Jackson and is expected to join the Advance Auto Parts Board of Directors. The combined company will be headquartered in Roanoke, Va., and will maintain a presence in Raleigh, N.C.

“This transformational transaction provides a compelling strategic opportunity for Advance to expand our geographic presence and commercial capabilities to better serve customers,” Jackson says. “The addition of 1,246

“This transformational transaction provides a compelling strategic opportunity for Advance to expand our geographic presence and commercial capabilities to better serve customers,”

— Darren Jackson, Advance CEO

company operated stores and 1,418 independently owned CARQUEST locations provides us with an immediate platform and scale across North

America, full market coverage and the opportunity to position ourselves as the market leader in the commercial business. We believe the combination of the two companies is a great fit and the synergy of GPII’s assets with our capabilities will allow us to capitalize on market opportunities that will create value for our shareholders and provide even better service to our customers.”

Sloan adds, “We are excited to bring together two highly complementary automotive aftermarket companies. The combination with Advance Auto Parts is the next logical step in our company’s evolution. Advance’s retail presence, strong capability infrastructure and acquisition integration experience combined with GPII’s leadership in the commercial, independent and import segments creates a powerful platform to drive profitable growth.”

AUTOSHOP SOLUTIONS LAUNCHES ITS NEW AUTOSHOP MAIL

Autoshop Solutions Inc. announced the launch of its latest marketing tool for the automotive industry: Autoshop Mail. Autoshop Mail takes direct mail to the next level by combining postcard mailings with an online marketing campaign, creating an easy user experience for the customer, and driving more traffic for the shop owner, the company reports.

The Autoshop Mail direct mail program sends out postcards, equipped with phone tracking numbers for accurate ROI measuring. It then takes direct mail marketing a step further by integrating it with an online marketing campaign. Customers and new leads who receive the postcards are directed to a mobile-compatible landing page on the shop’s website for more information. Then, utilizing the Google Display Network, ads matching the shops direct mail post-

card and branding will follow the new lead around the internet, helping the auto shop business stay top-of-mind and easily accessible for further engagement.

“This is going to revolutionize direct mail for automotive shops around the country,” Danny Sanchez, CEO of Autoshop Solutions, explained. “Autoshop Mail is not just postcards with a tracking number, it’s an entire marketing program that is trackable from start to finish.”

The Autoshop Mail program is designed to be convenient and effective for both the auto shop owner, and the potential new customer.

“Rolling out this integrated program to our customers is truly exciting,” Margaret Klemmer, VP Operations of Autoshop Solutions, said. “We take the branding and design from our client’s website and create a postcard, landing page and set of display ads that all match with the same branding, marketing message and offer.”

Autoshop Mail is the newest addition to the suite of marketing tools offered by Autoshop Solutions. For more information on Autoshop Mail, visit www.autoshopsolutions.com/mail.

NAPA center earns 5-star score

I-70 Auto Service has achieved a 5-star rating under the Green Garage Challenge program. I-70, through NAPA’s new GreenCareSM Certification program, has committed to fight climate change that will enhance the company’s value and help preserve the environment for future generations.

“I-70 Auto Service is pleased to join the fight against climate change,” said Joe Severt, owner. “Through the official EPA climate rating program, we can demonstrate our commitment to the environment and measure our efforts to reduce the risks of global warming.”

He notes in the past year, “we have saved more than 4,000 pounds of Greenhouse Gas emissions by reducing our energy usage and material consumption while increasing our service efficiency by more than 30 percent per hour.”

“The new NAPA AutoCare GreenCare program allows us to offer industry leading solutions and green sustainability support to our AutoCare centers in one package. In turn, our members can feel secure that they have credible evidence of an environmentally sound operation to help their business be more profitable,” said Bret Robyck, vice president NAPA AutoCare. “We’re making it easier for NAPA AutoCare Centers to become Green Certified and promote their Green initiatives in the marketplace.”



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QUESTION OF THE MONTH



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SURVEY: Technician A says that the pH level of the coolant in the customer's radiator is a good indication of the condition of the coolant inhibitor package. Technician B says a DVOM (digital voltmeter) can be used to accurately test coolant condition. Who is correct?

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

Go to MotorAge.com/nov13survey to answer this question and register for our monthly giveaway from our sponsor, Federated Auto Parts.



You might be flushing more than just fluids

Motor oil invoicing and you; what you need to know and consider.

BY KEVIN S. MCCARTNEY | WORKSHOP MEMBER

Early this year the California Bureau of Automotive Repair (CA-BAR) announced a new "Wallet Flushing" program. The program focuses on the inappropriate promotion of products and services to consumers. The primary target is the misrepresentation of flushes and supplements. CA-BAR emphasizes that they don't care what products and services a shop sells as long as the shop represents those products and services honestly.

In the past, I've spoken out loudly against CA-BAR actions and poli-

cies. But I can find no fault in forcing shops to be honest about the products and services they recommend and sell. CA-BAR is charged with monitoring and enforcing honesty and communication in the automotive repair industry. Effective enforcement of that goal is good for honest shops. So, why do you think shop owners, industry associations and chemical suppliers are fighting to stop this program?

This is not just a California issue. Virtually every state has an agency charged with enforcement of fair and honest business practices. Most have separate agencies or divisions for

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BEST OF THE BLOGS

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Junius/Alabama

Cheap parts = our enemy

I was backing my 1995 Taurus out of the driveway one Saturday morning several years ago, when a loud thump sounded from under the hood accompanied by a gaggle of illuminated warning indicators and an immediate loss of power steering assist. A peek under the hood revealed a broken belt tensioner, but the car had 180,000 miles on the clock, so it didn't owe me anything.

Around the corner at the local mass-franchise parts house, I paid \$80 for a replacement belt tensioner. It was a brand I recognized and looked OK, but the price was, I thought, a bit high. I paid the extra money because I needed the car that weekend. A few thousand miles later, the tensioner failed in such a way that the pulley was out of line with the other belt wheels and

the 3.0L started tossing its serpentine belt every few days. I threw the \$80 aftermarket tensioner in the trash and paid \$55 for an OEM replacement at the Ford dealership. This experience hasn't been unique — I've seen it many times before.

On more than a few occasions, when I've replaced a thermostat that was opening too cold, the replacement part opened even colder, and on today's emission-friendly engines, 210 degrees is a good temperature, but 170 degrees isn't. Not only does a perpetually cool engine prevent the emissions system from doing its job correctly, it promotes engine wear. Water is created in the combustion chamber, and as some of that vapor blows by the rings on a cooler-running engine, it tends to combine with sulphur in the lube oil to form sulfuric acid, which isn't good for the innards of any powerplant. In those cases where the first new thermostat didn't warm things up, I'd

finally get a good one after a couple of tries. It's more than just annoying if the thermostat replacement is a tough job.

AAGEditor/Ohio

The do's of hand hygiene

GOJO Industries, Inc. share tips for effective skin car protocols that you can implement in your shop and in daily life. Common sense though they may be, it is helpful to remember these important dos and don'ts!

Condition skin often. Before and after work and after each washing. Wash hands regularly. Wash with the right kind of cleaner. Use the mildest yet effective cleaner to remove soils. Keep tools clean to help keep hands clean. Wear PPE, including gloves, whenever possible.

DECEMBER 5TH 2013
@ 8:00 PM

Transmission Diagnostic Tips

While some fixes are transmission-specific, some diagnostic tips can help anywhere.



PAGE

8

COMPLETE ASRW COVERAGE

BY TSCHANEN BRANDYBERRY

Follow up on what you missed this year.

PAGE

14

Q+A WITH ERIC PETERSON

FORD

Learn about the Ford Atlas Concept.

PAGE

128

THE TRAINER VIDEO

BY PETE MEIER

Cabin air filter: Out of sight, out of mind?

automotive businesses. They must respond to consumer complaints and consumers are increasingly aware of Wallet Flushing. The number of websites and blogs discussing Wallet Flushing has increased dramatically

during the past six months. And, many of those websites, blogs and posts belong to the most respectable shop owners and technicians in the industry. Read more at MotorAge.com/walletflushing. *M*

LEARN MORE: MotorAge.com IS UPDATED CONTINUALLY

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NASTF Executive Director Skip Potter explains how NASTF provides very real benefits to the automotive service pro.

MotorAge.com/goodtechs

Twenty Group success

Stu Zurcher, president of the Strategic Alliance Group, talks of the concept for a Twenty Group for tire dealers.

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Why Delphi?

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Noteworthy

comments from MotorAge's online communities

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

garym:

How many shops charge at least \$150 and up depending on the type of repair? I'll bet not many, less than 1/2 of 1 percent. Until this industry changes and charges a fair price to compensate the qualified techs properly then this drama will continue.

eallenboggs:

I take training all the time (TST-G Truglia/Automotive Training Group/Carquest Technical Institute/BWD/SMP through O'Reilly Auto

Parts). What I see is the people in the classes have gray hair like me for the most part and are near retirement. Where are the guys who are going to take our place?

1Commett:

The simple nice things that people will do, often have had the most profound effects on me as well.

mulhernsauto:

What a great idea for independent shop owners, to band together and form a mutual support group. I

don't see much availability in the automotive repair industry for such opportunities to a shop owner. I know that there are several private companies who offer management specific training and support, but their master plan seems to conform everyone into their exact mold.

David Ballard via Facebook:

I was lucky enough to take classes in automotive, drafting, and agriculture. It was these classes that paved my path to where I am today.



STREAMING PROGRAMS

Breaking down marketing

Tim Ross, president of Mudlick Mail, talked with *Motor Age* about current marketing trends. If you're a shop looking into adjusting or bettering your marketing plan, check out what Tim has to say. He also addresses how you can make sure a marketing plan isn't just a fad and ways to get your whole staff involved.

What you're doing right

A short video clip from the "How to Increase Your Profits" seminar with Mike Lee talking about what auto shop owners are doing right in their shops.

NAPA at C.A.N.

Just one of several videos Technical Editor Pete Meier shot while he attended the recent C.A.N. Conference, hosted by ASA-Illinois.

NOV. 5-7

AAPEX/SEMA

Las Vegas.

JAN. 15-18

MACS Worldwide 2014 Training Event

New Orleans

MARCH 3-9

VISION HiTech Training and Expo

Kansas City, Mo.

MARCH 21-23

ASA-Northwest Automotive Training Expo

The NASTF spring meeting also will take place at the same time in SeaTac, Wash.



2013 INDUSTRY CALENDAR



the community—
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Q+A WITH ERIC PETERSON

F-150 MARKETING MANAGER,
FORD MOTOR CO.



THERE IS A LOT OF WORK THAT GOES INTO A CONCEPT VEHICLE BEFORE YOU EVER CAN LOOK UNDER THE HOOD.

BY PETE MEIER | TECHNICAL EDITOR

Eric Peterson, Ford's F-150 Marketing Manager, hangs out with *Motor Age* technical editor Pete Meier to talk about the Ford Atlas Concept. This million dollar platform hosts a variety of new technology, from improved aerodynamics to ease of use features like dynamic hitch alignment.

MA: This is the "birthplace" of ideas where you decide what to bring to market. Tell me about the history of the Ford F-Series.

EP: The history is 65 years of building trucks and knowing what customers want out of pickup trucks. Because of that heritage, we have a team that really knows what customers want and need out of a pickup truck. The thing about a pickup truck is you pick it because you need to do some type of work, whether it's towing your boat back and forth to the lake, you have a landscaping company or you're doing construction. ... It's also have more trucks on the road with 250,000 miles on them and leveraging that. That's how you get into sales leadership of 36 years. It's a continual evolution of listening to the customer and finding out what they need and what they want and being able to deliver that.

MA: How does the Atlas utilize other technologies available?

EP: There's a lot of technology that's already in place, so if you're designing a next-generation truck you really should leverage that technology wherever you can. So active grill shutters make a ton of sense. When you're at highway speeds, they close up. One of the biggest negative factors in fuel economy is drag, is poor aerodynamics. So active grill shutters in the front make a ton of sense, but some other things as well make a lot of sense, like an air dam that lowers at highway speeds so when you're going slow, it's up. ... It's a nod that every bit of the truck is important to fuel economy. Every bit is important to styling, so you have to make it work in harmony, and that's what the Atlas does in smart technology meets great design.

MA: The EcoBoost engine has received rave reviews, but now we're touting the next generation.

EP: The thing with EcoBoost, and it is next generation in and of itself, when we brought EcoBoost into the lineup for the 2011 model year, there was a little bit of hand-wringing in the industry. We were very confident with what we were doing. But for a



long time, there was no replacement for displacement. Through looking at things differently and leveraging diesel technology, basically turbocharging, we were able to bring class-leading torque, class-leading towing for an engine that still was a V6 that got you 22 mpg on the highway. People hadn't seen something like that before. The question would be does it stand up, does it work and we really tried to answer that before we launched it. Customers were confident in it.

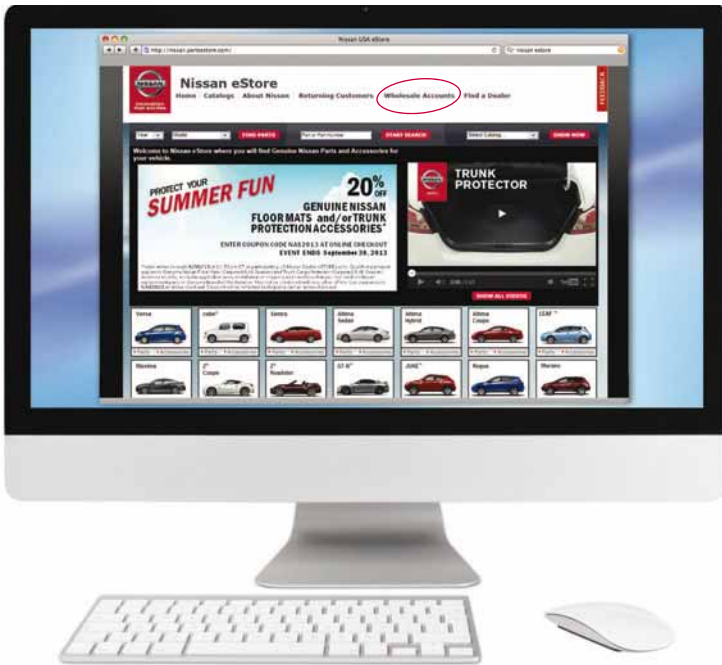
The thinking with the concept is while you can't really open the hood to take a look at it even if we had it live and in person here, we're going to continue to evolve EcoBoost and the thinking is that in the future we could make it smarter, make it tougher, make it more durable. **ZZ**

Photos: Pete Meier



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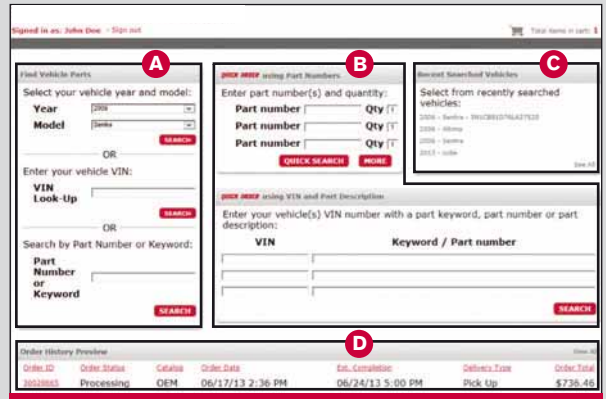
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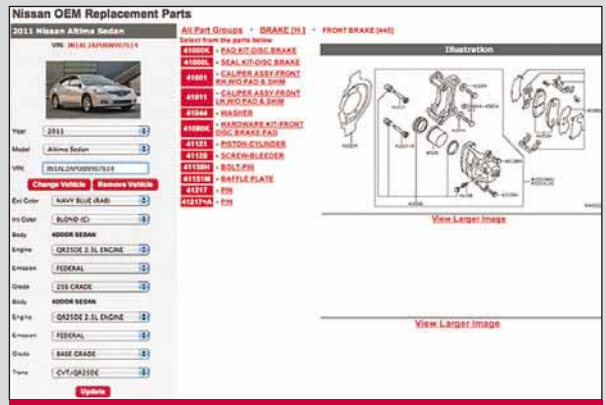
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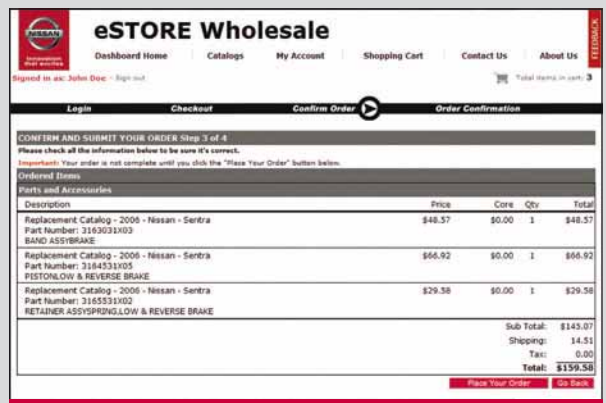
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- C** See recently searched vehicles.
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OPERATIONS

TAKE CONTROL
OF YOUR BUSINESS

IN THIS SECTION

- 16 Management
- 18 Profit Matters
- 20 Shop Profile

read it on **MotorAge.com**

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THE TOP SHOP

Pellman's Automotive in Boulder, Colo., is the 2013 *Motor Age* Top Shop

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MANAGEMENT

THE INTERNET, OUR SHOPS AND OUR TECHNICIANS



THE RESOURCES EMPLOYEES WOULD HAVE ACCESS TO OUTWEIGH YOUR FEARS ABOUT LOSING THEIR FOCUS.

BY **BRIAN CANNING** | CONTRIBUTOR

THOUGH I think the automotive repair industry has decidedly not made the most of broadband Internet services, I strongly believe the future of training, troubleshooting and diagnostics is very much tied to the use of the Internet.

In a previous career where I daily talked to shop owners and service managers across the country, I always was surprised how often I ran into shops that had dial-up Internet connections. The truth is about a third of all U.S. shops do not have any Internet connection. In this era of e-commerce, webinars and mobile technology, it is hard to imagine trying to run something as complicated as an automotive repair shop without the Internet. There are businesses trying to make it happen, though these shops are working with a handicap in an industry that is as changeable as automotive repair.

In this day and age, I do not know of anything that has revolutionized shop operations like the Internet and mobile technology. I say this knowing the automotive repair industry has been far too slow and much less imaginative in general than many other industries. But I would not want to think about creating estimates or ordering parts without the Internet, and certainly would not want to consider diagnostics and troubleshooting without the many online resources available out there today. Maybe you feel 100 percent comfortable with your techs' broad knowledge and their ability to handle anything and everything that would come in the door. But with deference to their ability, the Internet gives me access to knowledge and experience way beyond my four walls.

There is no doubt that bringing the Internet into your shop or expanding access to it could be a distraction to your technicians, but just understand that it is already there in the form of that smartphone your techs carry everywhere they go. And in the same way you need to provide oversight





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“MAYBE YOU FEEL 100 PERCENT COMFORTABLE WITH YOUR TECHS’ BROAD KNOWLEDGE AND THEIR ABILITY TO HANDLE EVERYTHING THAT WOULD COME IN THE DOOR. BUT WITH DEFERENCE TO THEIR ABILITY, THE INTERNET GIVES ME ACCESS TO KNOWLEDGE AND EXPERIENCE WAY BEYOND MY FOUR WALLS,”

BRIAN CANNING [CONTRIBUTOR]

and set standards for the use of cellphones in your shop, you need to do those same things with Internet access at workstations in your shop. It is only a problem if you let it become a problem and fail to provide guidance.

Online Resources and Techs

I know in that previous life I referred to, three of our big initiatives were selling maintenance, selling diagnostics and identifying service trends in the industry. We worked hard to educate and reeducate our technicians to approach these areas in new and different ways. All three of these represent areas where we, as an industry, miss out and where we could do a much better job.

We partnered with Identifix, though there are similar companies that could have been great partners in this effort. Identifix is a group of automotive people who have taken their (and all of our) real world experience and made it available in an accessible, user-friendly format that allows me, as a technician, to troubleshoot, diagnose and recommend based on the experience of the thousands upon thousands of technicians that routinely use the service. Nobody knows everything, but sometimes our expectations of a technician would seem to put an awful lot of weight on his or her shoulders.

An Internet-accessible service allows a technician to know what manufacturer specific maintenance services to recommend, to identify applicable Technical Service Bulletins (TSBs) and to better troubleshoot and diagnose performance problems based on the experience of technicians from across the U.S., Canada and Central America. That’s a lot of experience that would only be available to our technicians with Internet access.

Identifix started out as an auto repair hotline offering live technical assistance

According to a recent study, about one-third of shops don’t use the Internet for their vehicle repairs.
MotorAge.com/internetuse

to professional shop owners and technicians seeking a trusted second opinion and additional expertise on various vehicle issues. These hotline interactions have enabled them to compile an exclusive database of shortcut tests and confirmed fixes that have been document-

ed and made available to technicians standing in shops just like yours. The Internet has every opportunity to be a distraction and to be abused, but it also has untapped potential to make you, your shop and your techs better.

ALLDATA, a name that is very familiar to us of the automotive repair world, quite simply would not exist without the Internet. They are a huge, ready and available resource waiting for you and your technicians to log in.

With ALLDATA Repair, according to the company, you get online access that instantly provides unedited manufacturer information you need to deliver accurate repairs, including TSBs and recalls, complete OE wiring diagrams, diagnostic trouble code (DTC) descriptions, tests and procedure, component locations, Mode 6 data including PIDs, TIDs, CIDs and scaling, parts and labor integration information, TPMS reset procedures and more.

In addition to these two companies, the International Automotive Technicians Network (iATN), provides countless resources for your technicians. They can join forums with other techs, sharing information, solutions and asking questions of their own. It features a database of hundreds of thousands of vehicle fixes, a waveform library and OEM, industry and government resources. You can check it out at www.iatn.net.

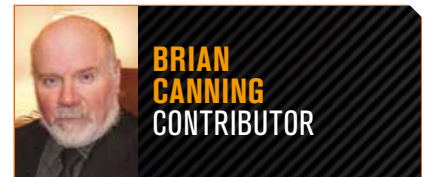
Another important resource available is online training. In years past, training was both expensive and inconvenient, requiring our technicians to be out of the shop, often for days at a time. Now

there are untold online training courses available, frequently broken into smaller modules, allowing for much more flexibility in getting our technicians trained.

Besides the many manufacturers that offer timely and relevant training, there are broad and in depth training programs available from I-CAR, AutoShop 101 and CARQUEST Technical Institute (CTI). Training has undergone a revolution in recent years and whether you are trying to stay current on emerging technology or want to study for an upcoming ASE test, the Internet offers unlimited access to what is out there and what you need to know to stay current and relevant in today’s automotive repair world.

The best argument for Internet access out in your shop is the revolutionary changes that have taken place on our counters. From parts ordering, to customer relationship management and marketing, the front end operation is barely recognizable from what it was 10 or 15 years ago. Customers often arrive at our counter as the result of an automated service reminder on their cellphone.

We now are able to communicate and interact with customers in ways that would have been unthinkable a few short years ago. Instead of describing the condition of their brakes to them, we now routinely send digital photographs of that wasted rotor or a video of the leak in their radiator. Why should you and your service advisors have all the fun. Access to all the resources that the Internet has to offer makes a good tech great and a great tech phenomenal. *ZZ*



BRIAN CANNING
CONTRIBUTOR

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

Email Brian at brimarc@hotmail.com

WANT TO GROW YOUR AUTO SHOP? COOK A POTATO FIRST

THERE ARE MANY WAYS YOU COULD COOK THAT POTATO. DECIDE WHAT YOU WANT FIRST, THEN MAKE YOUR PLAN — JUST LIKE IN THE SHOP.

BY CHRIS “CHUBBY” FREDERICK | CONTRIBUTOR

IF YOU have been in business more than 10 years, you are well aware of how hard it can be to keep growing your customer base. Our most successful clients spend a great amount of time focusing on growing their customer base in the hopes of simply stabilizing car count for their people. Last month, I overheard George Zeeks, who is our coaches' team leader, explain to a group of shop owners the basics of how to grow their shops. Many of us want to skip the basics or we never learned them in the first place, so let's hear what George had to say.

Try to remember the first time you bought a potato at the store. Everyone cooks them, so it has to be easy, right? The major problem is that they don't come with instructions. You can search Google or YouTube for what you need to know about cooking potatoes, but what if you didn't have that, or at least not as much information? Opening a new shop or trying to get yours to grow can be just as challenging.

So, as for that potato, you can grill it, fry it, boil it or bake it. Do you leave the skin on or off? My favorite is to core the center and insert cheese. Wrap the potato in bacon and, oh, remember to cut a small groove to put some butter in and then wrap in foil and cook on the grill. How do I know that? Trial and error. How do you run your shop? For many of you, it's the same way.



Working In It or On It?

I get it, you're a pro. You've been working on cars for years and doing your friends' and neighbors' cars for even longer. It's a huge difference when you actually open your own shop. Now there's no one paying you; you have to pay yourself. There are a ton of things you're just not prepared for.

You're probably better off not knowing how to turn a wrench. How many times have we been sucked into finding the lug nut key when a basic-level tech can't find it? The worst thing that you can do is go and find it for them. Now we have a \$50 head doing a \$10 head job. You're not an owner anymore; you're an entry-level helper. Do you think that a master chef is back there peeling the potatoes? There is no guide


to help you know what you should do on a day-to-day level, so let me give you some tips.

You might be in a hurry to be successful, so you might want to microwave the potato. How and how long? The same thing applies to running your shop. The first thing to consider is what kind of shop you have and what kind of you want to have?

JUST SCAN IT 

Scan this QR Code to get more on your smartphone. Or visit MotorAge.com/ProfitMatters1113

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“WHAT KEEPS MOST SHOP OWNERS FROM GROWING EVERY YEAR? THEY ARE TOO INVOLVED WITH FIXING CARS AND CAN'T SPEND ENOUGH TIME ON GROWING THEIR BUSINESS,”

CHRIS “CHUBBY” FREDERICK [ATI CEO]

Take a step back and watch the behaviors that are going on in your shop. Regardless of what you want the shop to be, the reality of what your shop has become is demonstrated by your staff's behavior. Take a step back and watch your crew in action. Do the behaviors you see reflect the values and culture that you wanted? There is a huge difference between a repair shop, a franchise, a quick lube, etc.

Follow a Daily Checklist

A huge thing to consider is what you are supposed to be doing each day to make your shop a success. Most of you have an idea, but the biggest problem is that you don't know what you don't know. Again, those of you who know how to turn a wrench will, inevitably, get sucked back into the shop. It's something that you know and are comfortable with, but it's not what is going to make you profitable.

You need to know what you have to do each day, day in and day out, to be a successful shop. You don't make much profit for just french fries, and almost anyone can do that. Unless you make the absolutely best french fries in town, then you are at the top of the heap. But if you want to be a shop that operates on a higher level, then you have to know what successful shop owners do, day after day, to get to that higher level and stay there.

I'm sorry. I forgot that some of you want the quick, easy and painless solution to the problem. You may want to microwave the potato. Well, it can be done, but you have to know how to do that, too. The major problem is that there is no easy, quick way to run your shop. It's hard work, and it might be hard to swallow for some of you. I get that you want to give great service and make all of your customers raving fans, but that takes hard work and a daily discipline that can be difficult for some.

The problem is not the hard work — all of you work hard — it's the things you must do that are outside of your comfort zone. I can give you some of the answers here, with more in the attach-



ment you can request. But you might not like all of the things you need to do each day to be that shop that people know is one of the best. I have a client who was one of *Motor Age's* top 10 last year, and I can tell you that it didn't come easy, but the rewards are great.

One of the most basic things is to reconcile the daily receipts in your point of sale system. That's like washing the potato before you cook it. It might seem basic, but some shops don't do it. Next, make sure you fix the problem that the customer came in for. I get it, it's basic, but a lot of shops still have a problem with that. A potato that's overcooked or undercooked is tough to eat. You only get the credit if it's cooked properly, just like fixing the customer's problem.

Another basic question that comes up is, are the margins right? Did you charge enough for the parts, and did you sell enough labor to keep all of the technicians busy and make a profit? Do you know what your labor inventory is? That goes back to knowing what type of potato we want to cook for our guests. If you are not using all of your labor inventory and not reaching your shop potential, then you are not maxing out what your shop can do. That results in lost profits and unsatisfied customers.

The Money Is in the Math

Do you even know what you expect from each day's production? If you don't know the math, then you are doomed to guess. The money is in the math, and those of you who don't want to learn it are doomed to mediocrity.

Another question boils down to are your customers happy? Do you know? Is it just a feeling, or do you have a consistent, repeatable process that will measure the experience that you provide?

If you want a checklist that will give you the guidelines to enable you to provide a profitable and satisfying customer experience, go to www.ationlinetraining.com/2013-11 to get a copy of our Leader's Operational Checklist. This is a limited time offer. After all, at the end of the meal, they don't remember how hard you worked, just the experience they had. *MA*



CHRIS “CHUBBY”
FREDERICK
CONTRIBUTOR

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

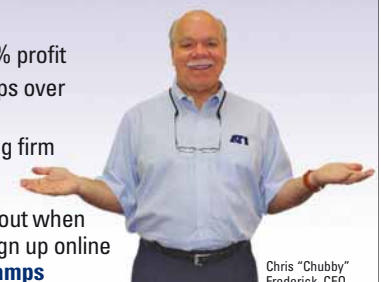
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Chris “Chubby”
Frederick, CEO

SHOP PROFILE

A snapshot of one of the industry's leading shops

BILL'S QUALITY AUTO CARE / SIMI VALLEY, CALIF.



Acting as the Negotiator

By being forced into the role of bookkeeper, this owner's eyes opened wider than he ever imagined.

BY **ROBERT BRAVENDER** | CONTRIBUTOR

You might call what Bill Garcia experienced an epiphany or eureka moment. With the loss of his bookkeeper, the owner of Bill's Quality Auto Care in Simi Valley, Calif., a *Motor Age* Top 10 shop in 2012, decided to look through the books himself. What he found wasn't shocking — his bookkeeper was good — but it was surprising.

"Bookkeeping was something I really ignored for a long time, and I've been into it for about two and half months now," Garcia admits. "And brother, you ever feel really ashamed? Thank God it was in the hands of someone who gave a (darn). It's been tough for me, but it has been an eye opener. This entire process will behoove the whole company."

By combing through budget minutia, Garcia has discovered hidden savings. Take his contract with the company that supplies and maintains the shop's uniforms, towels and rags. "We've been doing Quick Books since January of 2003," says Garcia. "We'd been doing business with this uniform company four years prior to that. So I went back to that date, I looked at how much money we spent with them, I looked at the

cost trend. One of the things that really opened my eyes is that I'd let a couple guys go and the bill actually went up. What the heck was going on?"

Turns out the company had charged more because some uniforms were embroidered. "I said, 'OK, you charged me full retail price for uniforms that (we've) had for three and half years,'" Garcia reasoned. "'Can't you get your ROI (return on investment) out of that and give me full retail on those things?'"

He also asked them to reconsider what they charged in towels, since the company used a formula that out of 200 towels supplied each week, his shop would lose or destroy 25 towels at 40 cents a towel.

"Long story short," says Garcia, "I got my bill negotiated down about \$200 a month."

AT A GLANCE

Bill's Quality Auto Care

Shop name

Bill Garcia

Owner

Simi Valley, Calif.

Location

1

Number of locations

20

Years in business

11

Total number of employees

4

Number of technicians

6,000 square feet

Shop size

12

Number of bays

90

Average vehicles per week

\$430

Average weekly repair ticket

\$2 million

Annual gross revenue

AAA

Shop affiliations

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MOTORAGE.COM/TOPSHOPS**

It was mostly little things, like area rugs. "We have three (generic) gray mats and one logo mat, and (the carpet

Photos: Bill's Quality Auto Care



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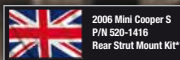


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A view of the alignment rack and shop bays at Bill's Quality Auto Care.



Even owner Bill Garcia has taken a turn driving the courtesy shuttle.

cleaner) charged me almost as much for the one logo mat as the three grays," reports Garcia. "Do they clean differently? Things like that added up to over \$50 a week. I'm paying \$11.34 a week for this logo mat, times 52 weeks, that's a \$600 floor mat. I've had that thing for four years; that's a \$2,358.72 floor mat. You can't give me a little love on this? Your ROI on this hasn't been good? I get it; everybody wants to make a profit, but tell you what, bill me full retail for the floor mat and then charge me laundry like you do the grey ones."

It's hard to argue with such logic, and Garcia seems to revel in it. "I refuse to hire another bookkeeper until we nail this down," he explains, "So I'm kind of going through my trial by fire here. I can hire somebody to help compile it, but I'm going to do it myself. It's like when you don't want to go to the gym and get on the treadmill for an hour; you'll find any excuse not to do it. But when you do it, you never regret it. I don't carry a briefcase right now, I carry a banker's box, a cardboard file box. The guys at the shop are making fun of me."

But as Garcia points out, since Bill's Quality Auto Care operates on profit sharing, this benefits everyone. "Every time I find a spare buck, everybody wins," he says, like dropping an unused phone from his cell plan. "When I start looking over the books, I have a whole list of things; what my payoff time is on certain pieces of big equipment, what can be renegotiated."

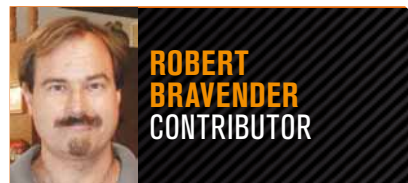
Garcia advises all business owners to at least take an occasional look at the books. "Most of the time I'm so busy dealing with the day to day. I don't sell work — I barely know how to use my shop managing program — but I go out and see what the techs are doing. I look for classes for them. I run to the cylinder head shop, on and on. But now that I'm buried in the bookkeep-

ing, after I'm done I say, 'I'm glad I did that, I'm tired; I need a beer!'"

This March 3 marked 20 years in business. "When I first opened, I had my checkbook and my little solar powered calculator," recalls Garcia. "That's how I did everything in my 712-sq.-ft., single-bay shop in the middle of nowhere. Now we do about \$2 million a year. We have families to support, we're members of the community. We're very proud of all that but when you look at all your duties and responsibilities you say, man I've got to do this right."

For example, how to better communicate with the client. "That's what makes our job never ending," he concedes. Bill's has a shuttle, which Garcia has had occasion to drive. "You learn so much. People say incredible things when they're riding. I've come back and said, 'Forget that tune-up; this lady has major drivability symptoms.' When I hire a shuttle driver, I tell them a lot of times they have more face time with these people than anybody. The impressions they give or get are very important. Sometimes I'll do it. I'll have some of my service advisors do it, but it's a key position."

So Garcia will continue to micro manage, at least for now. "But once I get good at this," he gleefully asserts, "I can't wait to hire someone else to shuffle papers!" *TM*



**ROBERT
BRAVENDER**
CONTRIBUTOR

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

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ONE PART TOUGH GUY... ONE PART SMOOTH OPERATOR

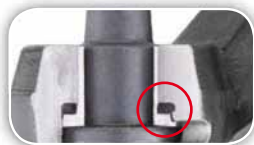
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Korea vs. Japan

THERE IS SOME HISTORY THAT RUNS BETWEEN THE TWO COUNTRIES, EVEN MORE SO WHEN YOU COMPARE TRANSMISSIONS IN VEHICLES FROM THE DIFFERENT LOCATIONS.

BY **WAYNE COLONNA** | POWERTRAIN PRO PUBLISHER

BEING neighboring countries, Korea and Japan have managed to enjoy a close relationship from ancient history to present day. As a result, similarities can be observed in both their development and economic growth. This little piece of history becomes interesting when we consider the similarities seen with transmissions being used in Mitsubishi, Hyundai and Kia vehicles. Perhaps I should re-phrase this to say, it is interesting to know the

similarities, but very essential to know the differences.

Let's consider the front wheel drive five speed transmission (Figure 1). With this transmission being in three different car manufacturers, more than several different names have been designated to identify this transmission. You will see names like the F5A5A, the F5A51, A5HF1 or the A5GF1 for this unit. These transmissions can be found here in North America in the Mitsubishi Eclipse and Galant, Hyundai

XG300/350, Sonata, Santa Fe, Azera and Entourage as well as Kia Amanti, Sedona and Sorento.

To break this down a bit more, this five speed transmission can have six or seven solenoids on the valve body (Figure 2). All Mitsubishi applications using this transmission will have six solenoids. Only Hyundai and Kia can this transmission have six or seven solenoids (If you see a unit with only five solenoids, this is the previous 4 speed version called the F4A40/50 series transmission as seen in Figure 3).

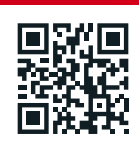
There are a couple of ways to know if the Korean applications are fitted with six or seven solenoids. One way is to look at the solenoid case connector. If there are 10 terminals it is a six-solenoid arrangement. If there are 12 terminals (Figure 4), it is a seven-solenoid arrangement.

Another method is to look at the identification number etched into the case (Figure 5). If the first digit is the letter Q, it is a six-solenoid arrangement. If it is a U or a V, it is a seven-solenoid arrangement. The U typically is a 3.333 overall gear ratio transmission (third digit: K) while the V is typically a 3.311 (third digit: J). The first digit letter also identifies the name of the transmission. The Q means it is the F5A51 transmission. The U is the A5HF1 and the V is the A5GF1. The second digit in the identification number indicates the year. The



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

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example shown in Figure 5 is a 2006 A5HF1 3.333 ratio transmission.

Now knowing that Hyundai and Kia could have six or seven solenoids, why the extra solenoid and what effect does this difference make with the operation of this transmission? This is a good question to ask and is essential to know the answer if you would like to diagnose this transmission correctly.

To begin to answer this question, let's first identify the six solenoids used in both configurations. Looking at Figure 6, beginning on the top left side of the valve body is the Overdrive Solenoid (OD). Next down is the Low/Reverse (LR), and below that the Reduction Brake (RB) solenoid. Top right is the Underdrive (UD), then the 2nd Brake (2B), and below that the Torque Converter Clutch or Damper Clutch Control (TCC/DCC) solenoid. These six solenoids are responsible for both shift sequencing and shift feel.

The seventh solenoid that was added, which is located at the bottom left side of the valve body, is called the Variable Force Solenoid (VFS). This solenoid is used for finer line pressure control as

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well as allowing for lower line pressure to occur during idle. With six solenoid valve bodies, approximately 130 psi is seen in gear at an idle, while approximately 60 psi is seen with units using the added VF solenoid. This added strategy offers improved fuel economy, as there is less effort for the engine to turn a pump with 60 psi as opposed to 130.

The addition of this VFS for the purpose of fuel economy was not the only change that took place. The components used to make the 3-4 and 4-5 shift also have changed. The clutch application chart provided in Figure 7 is for the six-solenoid valve body configuration. There are three components to observe in this chart: the 2nd Clutch, the Direct Clutch and the Reduction Band.

The 2nd Clutch is applied for 2nd and 5th; the Direct Clutch is applied for 4th and 5th while the Reduction Band is on for every gear except 4th and 5th. Compare this to the application chart provided in Figure 8 for the seven-solenoid configuration. Notice that the 2nd Clutch is used for 2nd, 4th and 5th. They added the responsibility of 4th gear to this clutch. Meanwhile,

the Direct Clutch is applied for 5th gear only now, while the Reduction Band is on for every gear except 5th.

These are notable differences to take into consideration when diagnosing any shift concerns from 3rd to 4th and 4th to 5th. The Reduction Band and Direct Clutch would be areas of concern for a flare 3-4 shift with a six-solenoid set up. These same components (should they malfunction) will cause a 4 to 5 flare on the shift with seven-solenoid style units in case you are wondering, a flared shift means to have an engine spin up during a transition from one gear to another.

Because the computer shifts the transmission through all the gear via solenoids, logically then, shift solenoid commands would have had to change as well. And they had. Figure 9 provides a solenoid application chart for the six-solenoid VB. Figure 10 for the seven-solenoid VB. This too is important to know in the diagnostic process as solenoids and their associated valves in the valve body can cause flared or harsh shift transitions should they malfunction.

Hyundai produced an informative bulletin regarding shift issues. It is bulletin 08-AT-003 entitled AT Harsh/Delayed Up-Shift/Downshift. It offers the following diagnostic steps to resolve these shift issues:

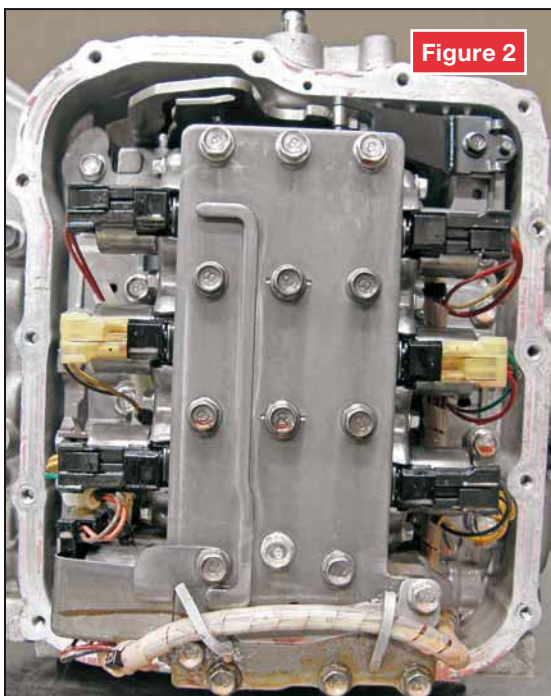


Figure 2



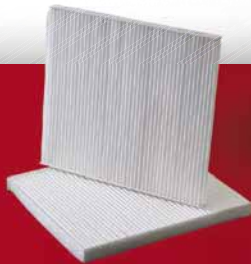
Figure 3

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1. Check the ATF level when the engine is idling in "N." Adjust the ATF level as needed.
2. Reset and relearn the adaptive values.
3. Compare to a similar model and year vehicle. If the shift delay is longer than the comparison vehicle, continue with the diagnosis.
4. Attach the GDS and check for Diagnostic Trouble Codes in both the "Engine" and "Automatic Transaxle"

menu. If DTCs are found, repair according to the appropriate TSB or shop manual.

Fluid level is the first check to be made, followed by resetting adapts. These two points are critical and should not be overlooked. It is important to note that the TFT sensor needs to be functioning correctly to obtain a proper fluid level. There can be issues with the sensor, which will be covered later in this article.

Some aftermarket scan tools are not able to reset transmission adapts for 2006 and later vehicles. This forces the use of an OE tool to perform this procedure. To bypass this step could send you off on a wild goose chase. It's better to shoot it the first time.

Many of us do not have the luxury of being able to compare to a similar model and year vehicle. Sure would be nice if it could be done, but most of the times, the problem at hand cannot be passed off as "normal operation."

The next step is to see if there are codes and, if so, they should be taken care of accordingly. But, if there are no codes, this bulletin goes on to explain how to use their OE tool to review captured data and measure the time length of a solenoid for a specific shift. Using the 1-2 shift as an example it says:

Read the 2nd solenoid elapsed time at the top right of the screen. If the 1-2 shift requires more than 2.0 seconds, exchange a PCM or TCM from a properly operating vehicle and fol-

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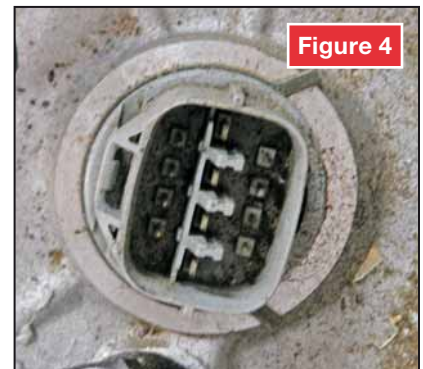


Figure 4



Figure 5

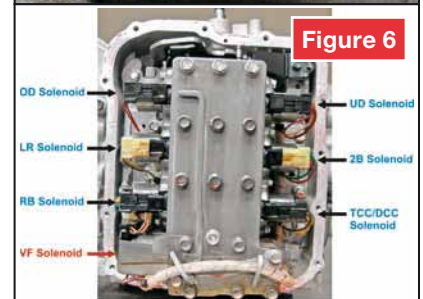


Figure 6

Figure 7											Figure 8										
Gear Range	Reverse Clutch	Underdrive Clutch	2nd Clutch	Overdrive Clutch	Low/Rev Clutch	Direct Clutch	Reduct Band	Low (OWC-1) Sprag	Reduct (OWC-2) Sprag	TCC	Gear Range	Reverse Clutch	Underdrive Clutch	2nd Clutch	Overdrive Clutch	Low/Rev Clutch	Direct Clutch	Reduct Band	Low (OWC-1) Sprag	Reduct (OWC-2) Sprag	DCC
Park					ON		ON				Park					ON		ON			
Reverse	ON				ON		ON				Reverse	ON				ON		ON			
Neutral					ON		ON				Neutral					ON		ON			
Dr-1st		ON			ON*		ON	HOLD	HOLD		Dr-1st		ON			ON*		ON	HOLD	HOLD	
Dr-2nd		ON	ON				ON		HOLD		Dr-2nd		ON	ON				ON		HOLD	
Dr-3rd		ON		ON			ON		HOLD		Dr-3rd		ON		ON			ON		HOLD	
Dr-4th		ON		ON		ON				ON**	Dr-4th		ON	ON	ON			ON		HOLD	ON**
Dr-5th			ON	ON		ON				ON**	Dr-5th			ON	ON		ON				ON**

* Low/Reverse clutch is applied below 6 mph, released above 6 mph.
 ** TCC dependant on throttle position, temperature and vehicle speed.

* Low/Reverse clutch is applied below 6 mph, released above 6 mph.
 ** Damper Converter Clutch (DCC) dependant on throttle position, temperature and vehicle speed.

low TSB 06-40-005, "Reset and Relearn Adaptive Values":

- If the condition is improved, replace the PCM or TCM
- If the condition is not improved, replace the transaxle.

Whether or not you have a PCM or TCM to replace as a donor, there are a couple of informative points provided in this diagnostic procedure. First, it is possible to have a malfunctioning computer causing these shift complaints. Secondly, the elapsed time allowed for a solenoid to make a shift should not exceed two seconds with a good oper-

ating computer. This can be very helpful, as shift complaints are very common with these units and there is a multiplicity of reasons. So if you can rule out a bad PCM/TCM as soon as possible, you know you are into the unit.

As mentioned previously, the solenoid case connector differs between these two style transmissions. When the Variable Force Solenoid (VFS) was added, this required two extra terminals to be added to the connector causing the original 10 pin configuration to go to 12. The computer provides power and ground to this solenoid

independently from all the others. All the other solenoids share the same power via a relay and are controlled by the computer on the ground side. What is unique about the power supply to these solenoids is that once the relay closes, the power is supplied to three of the solenoids through one terminal and three solenoids through a different terminal.

Figure 11 provides a view of the 10 way case connector for the six-solenoid valve body arrangement. To conduct a resistance check on the UD, 2nd and OD solenoids, the common



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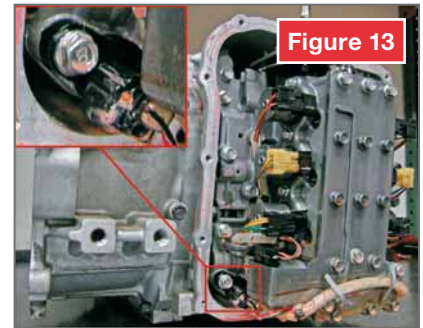
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Figure 9							Figure 10							
Gear Range	U.D. Sol	2nd Sol	O.D. Sol	TCC Sol	L/R-Dir. Sol***	RED. Sol	Gear Range	U.D. Sol	2nd Sol	O.D. Sol	DCC Sol	L/R-Dir. Sol***	RED. Sol	Line VFS Sol
Park	ON	ON	ON	OFF	OFF	OFF	Park	ON	ON	ON	OFF	OFF	OFF	****
Reverse	ON	ON	ON	OFF	OFF	OFF	Reverse	ON	ON	ON	OFF	OFF	OFF	****
Neutral	ON	ON	ON	OFF	OFF	OFF	Neutral	ON	ON	ON	OFF	OFF	OFF	****
Dr-1st	OFF	ON	ON	OFF	OFF*	OFF	Dr-1st	OFF	ON	ON	OFF	OFF*	OFF	****
Dr-2nd	OFF	OFF	ON	OFF	ON	OFF	Dr-2nd	OFF	OFF	ON	OFF	ON	OFF	****
Dr-3rd	OFF	ON	OFF	OFF	ON	OFF	Dr-3rd	OFF	ON	OFF	OFF	ON	OFF	****
Dr-4th	OFF	ON	OFF	ON**	OFF	ON	Dr-4th	OFF	OFF	OFF	ON**	ON	OFF	****
Dr-5th	ON	OFF	OFF	ON**	OFF	ON	Dr-5th	ON	OFF	OFF	ON**	OFF	ON	****



CASE CONNECTOR TERMINAL IDENTIFICATION AND INTERNAL COMPONENT RESISTANCE CHART

Mitsubishi, Hyundai & Kia 10-Way Connector

View Looking Into Transaxle Case Connector

View Looking Into Transaxle Harness Connector

Figure 11

INTERNAL COMPONENT RESISTANCE CHART

COMPONENT	TERMINALS	RESISTANCE
Underdrive Solenoid	Terminals 9 and 3	2.7 - 3.4 Ohms @ 20°C (68°F)
2nd Solenoid	Terminals 9 and 4	2.7 - 3.4 Ohms @ 20°C (68°F)
Overdrive Solenoid	Terminals 9 and 5	2.7 - 3.4 Ohms @ 20°C (68°F)
Low/Rev Solenoid	Terminals 10 and 6	2.7 - 3.4 Ohms @ 20°C (68°F)
TCC Solenoid	Terminals 10 and 7	2.7 - 3.4 Ohms @ 20°C (68°F)
Reduction Solenoid	Terminals 10 and 8	2.7 - 3.4 Ohms @ 20°C (68°F)
TFT Sensor	Terminals 1 and 2	(Varies) 0°C (32°F) - 16.7K-20.5K (low temp) 100°C (212°F) - 0.57K-0.69K (high temp)

terminal is 9, whereas terminal 10 is the common terminal for the L/R, TCC and Reduction Band Solenoid. These are the two split power supply terminals from the relay.

Figure 12 provides a view of the 12-way case connector for the seven-solenoid valve body arrangement. To conduct a resistance check on the UD, 2nd and OD solenoids the common terminal is 5, whereas terminal 6 is the common terminal for the L/R, TCC and Reduction Band Solenoid. These are the two split power supply terminals from the relay. You also can see that the Variable Force Solenoid has its own independent circuit through terminals 7 and 8. Terminal 7 is the high side while terminal 8 is the low side.

One other item to mention is the transmission fluid temperature sensor (Figure 13), which happens to be terminals 1 and 2 in both configurations. Terminal 1 is the signal wire with terminal 2 being the ground side. This temperature sensor, or the internal wiring harness that plugs into the sensor, is known to fail. It can produce codes P0711 (Rationality), P0712 (Circuit Low) and P0713 (Circuit High). This sensor will affect shift and TCC scheduling as well as shift feel. Correct TFT readings are also needed to ensure correct fluid levels as the level needs to be checked between 158-176° F.

Using the resistance specifications provided in Figure 11 from the case connector, checking the sensor at the case connector and then again directly on the sensor itself will usually locate the problem. The sensor itself can be purchased separately for between \$16 and \$20, part No. 46386-3A050. The wiring harness is a bit more expensive. It can be purchased for between \$160 and \$200 dollars. The part number is 46308-3A550. **ℤ**

Figure 12

CASE CONNECTOR TERMINAL IDENTIFICATION AND INTERNAL COMPONENT RESISTANCE CHART

Hyundai & Kia Only 12-Way Connector

View Looking Into Transaxle Pass-Thru Case Connector

View Looking Into Transaxle C-110 Harness Connector (Hyundai) C-03 Harness Connector (Kia)

INTERNAL COMPONENT RESISTANCE CHART

COMPONENT	TERMINALS	RESISTANCE
Underdrive Solenoid	Terminals 5 and 3	2.7 - 3.4 Ohms @ 20°C (68°F)
2nd Solenoid	Terminals 5 and 4	2.7 - 3.4 Ohms @ 20°C (68°F)
Overdrive Solenoid	Terminals 5 and 12	2.7 - 3.4 Ohms @ 20°C (68°F)
Low/Rev Solenoid	Terminals 6 and 11	2.7 - 3.4 Ohms @ 20°C (68°F)
DCC Solenoid	Terminals 6 and 9	2.7 - 3.4 Ohms @ 20°C (68°F)
Reduction Solenoid	Terminals 6 and 10	2.7 - 3.4 Ohms @ 20°C (68°F)
VFS Solenoid	Terminals 7 and 8	4.0 - 5.0 Ohms @ 20°C (68°F)
TFT Sensor	Terminals 1 and 2	See Figure 11

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BY **MARK DEKOSTER** | CONTRIBUTING EDITOR

Does this sound familiar? Consumer: "What oil belongs in my car?" "Expert" response: "Doesn't make any difference. Just put the cheapest stuff you can find." Or, "I know your car calls for 0W-20 but that's too thin. Put straight 40 weight in it."

It's bad thing when the "expert" is Uncle Joe, the shade tree genius; it's close to criminal when the "expert" is one of us in the industry. Once upon a time, you could get away with putting just about any fluid in a vehicle. Today, put the wrong oil in an engine and you might cut its life down to a few weeks.

That goes for all of the other fluids in a vehicle. Put the wrong oil in a CVT transaxle and you won't get out of the parking lot. The wrong coolant or coolant blend and the heat exchangers might begin leaking within hours.

Using the incorrect brake fluid could result in an accident and legal liability. Wrong transmission fluid can lead to poor shifting or worse regardless whether it's an automatic or manual box. Power steering fluid can change the life of the steering box. It can also effect the braking system on vehicles with hydro-boost.

Use the wrong oil in an A/C system, especially the high-voltage units in a hybrid, and you could end up replacing every A/C component on the car to correct the mistake. Things have changed a lot.

Unfortunately, this is a topic that gets people's dander up, so let me start with one statement that is as close to an absolutely true, inarguable statement, as we can in this business, and then we can move on: There is only one way to ensure that you are using

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the correct fluids for your customers. Use only fluids that are recommended and approved by the manufacturer.

What is arguable is whether there are better products than the factory recommended and approved. Can you find and use fluids that are better than OE? The answer is a definitive, yes, no and maybe. Though I'm still not sure one can have a rational discussion about DexCool, the question is answered by knowing what the manufacturer requires and then doing some real research into products.

We all have seen the statement by an OE saying that not using a certain fluid might result in the warranty being denied. A disclaimer to this statement: Under the Magnuson-Moss Warranty Act, a manufacturer cannot force you to buy or use a specific name-brand product to maintain a warranty. What

Photos: Mark DeKoster

they can require is that fluids and components used must meet their standards or they might be able to deny a warranty claim.

Each manufacturer will have specific specifications for fluids. If you want to use something else, your task is to determine what makes an oil meet dexos1™ specifications, for example, and then see if you can find one that has equal to or better than those specifications, if it is not GM approved.

Keep in mind that a manufacturer of fluids might advertise that its fluids exceed manufacturer's specifications. Laws related to what and how they can advertise are somewhat loose. Which specifications do they exceed?

Also complicating the process is when a manufacturer revises specifications of product and then does not grandfather them to previous models. Here's an example. When I worked for Ford, I was in new model training for the 6.0l PowerStroke. Engineers from Navistar did part of the training. As they discussed the coolant requirements for this engine, they talked about the benefit of using the new MotorCraft Premium Gold coolant. It had all of the additives for a diesel already in it. It was the factory



fill, and both Navistar and Ford recommended and approved it.

I asked them if we could recommend that technicians use this new coolant in the 7.3l engines. Their response was, "No."

When I pressed them to explain why, one of them simply stated that they had not tested that coolant on those engines and so they did not know if the chemical mix in that coolant was compatible with the materials in the 7.3l engines.

In reality would MotorCraft Premium Gold work in those engines? Yes, however the real question is for how long would it work? Does Ford recommend it yet? No, it does not.

I know many of you will want to email me and tell me that you have successfully used this or that, and I believe you. I'm here to tell you that it only takes a small amount of time on the web to find out that using fluids other than specified sooner or later will have an effect. I can give story after story from just my experience with Ford of technicians who related the tales of woe from people who used the wrong fluids in their vehicles. Oil filters blown off at startup due to wrong weight, variable cam timing mechanisms unable to move due to

sludge. Was that sludge from lack of maintenance or non-approved oil?

Let me illustrate clearly the value of using the correct fluid in your vehicle and in your customer's vehicles. In this case oil.

I owned a 2002 Ford Focus and put 200,000 miles on it before passing it on to my sister-in-law. I work 66 miles from my home, so I am filling up every other day and can keep track of fuel economy easily. I had an oil change at a local Ford Dealer. At my next fill-up two days later suddenly my fuel economy was down from 30 to 26 mpg. Again two days after that, still at 26 mpg. I got my IDS out and looked at numbers, no codes, fuel trims normal, MAF frequency were it belonged.

The problem? They put the wrong oil in my car. I don't know what it was, but as soon as I went to Motorcraft Semi-Synthetic 5W-20 (recommended and approved) my fuel economy went back to 30 mpg.

I recently was talking with someone and told them this story and they related their experience. This person had purchased a Honda with around 200,000 on it. It got very poor fuel economy. Talking with the previous owner that person had used a much thicker oil than recommended. The new owner has been using the correct grade of oil and now is getting five to six miles per gallon better than when he bought it. Yes the other "worked," but at what real cost?



The Motorcraft Premium Gold coolant we speak of above.



The Castrol Product in the center I can use without worry in a GM vehicle. It is dexos approved.

Why It's Important Today

Why the need for this concern today as opposed to yesterday? Take a look at engine specifications from engines in the 1960s, '70s and '80s and then look at a modern modular engine. Typical engine tolerances today are in the .01-.02mm range. Now if those numbers don't mean much to you because you learned English numbers let's convert: .02mm rounded up is .0008 inch. That is not a typo. Two hundredths of a millimeter is less than one thousandth of an inch.

Trying push a 40 weight oil through a space that was engineered for 20 weight simply might reduce fuel economy, or it might cause engine damage. It might not exhibit any concerns for miles, or it might not get out of your parking lot.

At this point some of you are still saying that, "OEs buy oil in bulk at the cheapest price and lowest quality they can find to make it work." When I was still working for Ford, I had access to some of the internal engineering sites on the Ford Intranet. I have two documents, which I cannot share copies of, that discuss this point.

One was the spec sheet for bid for oil companies to provide oil for factory fill. At the time of the document's creation Ford was anticipating the new ILSAC GF3 spec. They created specs for the 5W-20 oil that matched the anticipated GF3, in some case making the match the minimum requirement. An oil company was free to bid at the minimum requirements or exceed those requirements if they wanted to provide the factory fill.

In reality this same process goes on for all fluids in OE vehicles.

So the next question to answer is if you want to use a different brand how do you decide what will or won't work? With oil it would be wonderfully simple if all you had to do was go to the American Petroleum Institute (API) service classification list and choose your substitute oil by picking the latest classification and then the appropriate weight. Now that's a good place to start but there are still cautions to concern yourself with as I described above.

You also need to be concerned with International Lubricant

Standardization and Approval Committee (ILSAC) standards and ACEA, which is the European Automobile Manufacturers' Association. An oil might meet API Service Classification SN but might not meet ILSAC G5. Likewise, an oil might meet an API and ILSAC classification but not ACEA. ACEA classifications are letters with numbers such as A1, A2, etc. ACEA has letter designations for different engines, going A to E.

What you will need to do is to search out the specification sheet for the recommended approved fluid that you wish to change. You might need to pull the Material Safety Data Sheets (MSDS) sheets as well. You then compare what the fluid is to the fluid you want to use in its place. As you do this you will find out some interesting things. For example. Let's look at a spec sheet for a couple of Castrol Edge products.

Castrol Edge with Syntech Power Technology		
Viscosity at 100oC in cSt using ASTM D445 standards	0W-30	5W-30
	12.21	10.70
Castrol Edge with Titanium Fluid Strength Technology		
Viscosity at 100oC in cSt using ASTM D445 standards:	5W-20	5W-30
	9.1	9.8

Castrol Edge with Syntech 0w-30 is substantially thicker at 100C than their 5w-30. In fact the 0w-30 is almost a 0w-40 oil. Castrol Edge with Titanium is a "thick" 20 and "thin" 30. Look at the chart below for viscosity for the different weight classifications.

Weight	Viscosity cS at 100°C
20	5.60-9.29
30	9.30-12.49
40	12.50-16.29

You cannot simply use just the viscosity rating to make your choice. That is not saying that either of these is a "bad" oil. Knowing whether the oil you want to use is thick or thin is simply one of the things you need to know before you make a change.

But There Are More Fluids Than Just Motor Oil

Coolant has the same issues. There basically are three types in common use today. In and of themselves they are not really compatible. Therefore is there such a thing as a universal coolant? I was convinced that there wasn't for many years. In 2012, I was one of a number of trainers who was invited to Prestone's headquarters and given a tour, training, and a chance ask the questions of the chemists who make their products.

After the training, I have come to the conclusion that yes, there are coolants that are top-off compatible with OE coolant. But how can that be? I have to admit that having a chemist who holds multiple patents from different countries tell me that a product can be created that is chemically compatible and then show how they test the product to confirm compatibility



Wait a minute, why is there pink coolant in this 2012 Ford Focus?



Ford has clearly shown you what weight of oil to use, no mystery here.



This oil meets ILSAC G5, ACEA A1/B1, and API SN. It still may not meet the requirements of the vehicle you're working on.

is pretty compelling. You still need to check the specs.

Like our discussion of oil above, coolant has standards set by the OE, and these can be compared to the aftermarket product and a decision can be made. Also, as our discussion above suggests, correct maintenance, inspection by owners and technicians are critical factors in making sure that coolant stays coolant and not a reactive sludge that eats water pumps and heater cores for lunch.

In my research and observation, the main cause of early cooling system failure is incorrect servicing. Whether it is the tech doing a service who doesn't check the level and acidity to trying to change out coolant without using the tools needed to get 100 percent of the old out. To the owner, dumping something in themselves, proper maintenance is the key to long life of even long life coolants.

Perhaps the No. 1 cause of cooling system damage over time comes from a system that is not full and has air in it. CO₂ and O₂ will react with the coolant and will begin to create an ooze that might result in electrolysis, cavitation, or blockage. That's a broken vehicle that might need hundreds to thousands of dollars of repairs.

Brake fluid, power steering fluid, transmission fluid and rear axle fluid, every single one of these fluids has an OE specification, and every single one, like oil and coolant, have aftermarket products that claim to be better than

what came from the factory. Some of them are and some of them aren't.

Pretty much all of today's vehicles are easily capable of two hundred thousand miles of mostly trouble free operation. As I said above the "easiest" way to help your customers is to use fluids that are approved by the OEM. Finding fluids that are better than OE requirements requires you to put in some serious research and to continue to stay up on changes in fluid specifications and OE recommendations. Even if you choose to use OE approved, you still have work to do to keep current.

At this point in the this piece I could start laying out how to read the API Starburst, discuss the ILSAC and ACEA specs in some sort of a graph, but the teacher in me won't let me.

“How do you go about trying to find non-approved fluids that are better than or even simply meet OE requirements? You will need to familiarize yourself with the organizations that certify fluids.”

Oil requirements change too fast and too often for me to do that. You need to learn how to do it for yourself. I have laid out a case for your need to be:

- Vigilant in keeping up with changes in requirements by the OEMs.
- Move beyond just looking at listed viscosity ratings.
- Move beyond advertising claims.

How do you go about trying to find non-approved fluids that are better than or even simply meet OE requirements? You will need to familiarize yourself with the organizations that certify fluids. You will need to learn enough about terms like viscosity, high temperature/high shear viscosity, pour point, centiStokes and other specifications for the fluids you want to use.

1. Throw out your old attitudes about thicker vs. thinner oil, importance of color of coolant (it's not a valid check), etc.

2. Get over the attitude that "It worked for me in the past, it will in the future."

3. Find the OE's requirements for the fluid.

4. Look for TSBs related to changes in recommended fluid applications.

5. Find the specifications for the fluid you are considering.

6. Compare the specifications and make your determination.

Those first six steps are the easy part. After finishing those, you will need to:

1. Educate your employees to properly inspect and service vehicles.
2. Educate your customers of the needs of today's vehicles including
 - a. interval inspections.
 - b. unique fluid requirements.

There are a number of places on the Internet to help you become acquainted with and perform your research. One of these is Bob the Oil Guy (www.bobistheoilguy.com), while another good resource is to become a sponsoring member of iATN (www.iatn.net) and search the forum archives. Of course, there are also articles that have been in *Motor Age* over the years that you can look up as well. Again, let me caution you to keep in mind when articles were written. This stuff changes all the time; what was true three years ago likely is outdated and wrong today.

It is a challenge and just another example of why being in the automotive repair industry is not for the faint of heart. Making sure your customers get the best products in their vehicles requires you to be a detective, student, educator and diplomat. *MA*



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

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

Figure 3



**WHEN A TRANSMISSION WON'T SHIFT PROPERLY,
IT MAKES TRYING TO FIX A PROBLEM EVEN MORE DIFFICULT.**

BY **WAYNE COLONNA** | POWERTRAIN PRO PUBLISHER

If you are not aware, Honda and Acura transmissions do not shift properly while on a lift with the wheels off the ground. In fact, many shops have lost time and money thinking there is a transmission problem when there is not. The transmission exhibits erratic shifts conditions that otherwise would not occur if driven on the road. The transmission would be removed needlessly numerous times, and computers would be changed to no avail. All this time, had the tech driven it on the road, the transmission would have operated flawlessly.

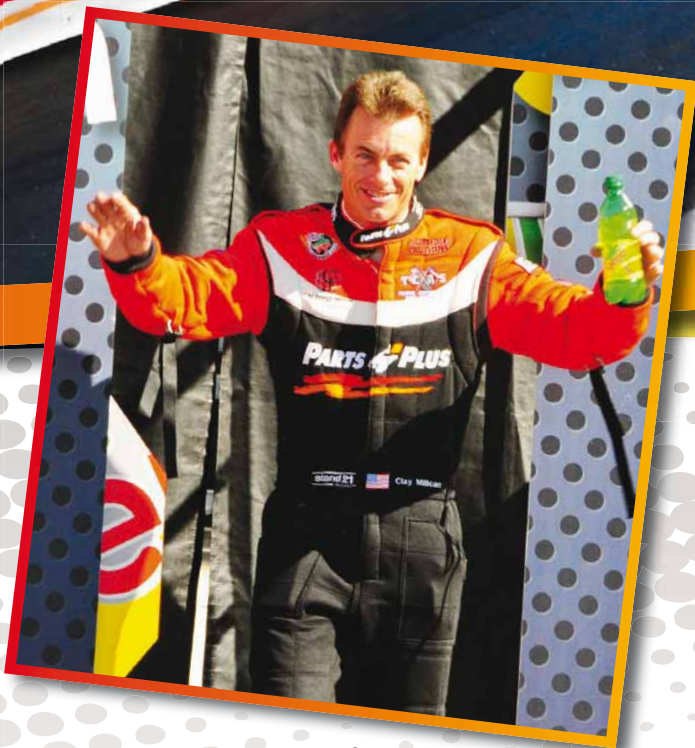
Recently, a 2003 Honda CRV with an MCVA transmission was rebuilt and installed into the vehicle. The tech knew not to drive the transmission on the lift, so he filled the unit with all four wheels on the ground. When he placed the selector lever into reverse to back off the lift, he had no movement. So he placed the selector lever back into Park and checked the level. It was full. He tried it again and still no reverse. This

time the MIL illuminated. After placing the transmission back into Park, he checked for codes and pulled P0780, a mechanical problem in the hydraulic control system.

Honda suggests to record all freeze data as well as to review general troubleshooting information before troubleshooting. In other words, get your head around the basics before overshooting



Figure 1



“Racing is a team sport. These are my MVPs.”

Clay Millican



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Figure 2

the troubleshooting process. It then says to obtain seven replacement solenoids, the three pressure control solenoids A, B and C and four shift solenoids, A, B, C and E (Figure 1).

The first set of solenoids to replace is all three of the pressure control solenoids. It then says to erase the code by pulling the No. 6 ECU 15 amp fuse from the underhood fuse/relay box for more than 10 seconds. Afterward, drive the vehicle forward for several minutes. Do this six times, and if code P0780 returns, change all the shift solenoids.

Well, these three pressure control solenoids were replaced, yet they still had no reverse and P0780 returned. So, all four shift solenoids were replaced. Can you suppose what happened? Of course, no reverse. This time, however, the selector lever was placed into drive and it engaged. They then placed the selector lever into reverse and it moved.

When the vehicle was driven, it shifted badly. Code P0780 remained, yet codes P0715 and P0720 also emerged. These are codes for problems with the mainshaft and countershaft speed

sensor signals. What a mess. But the problem is that the speed sensors accidentally were cross-connected, as seen in Figure 2. The harness with the black connector is plugging into the mainshaft speed sensor, while harness with the blue connector is plugging into the countershaft speed sensor. Figure 3 shows the correct plug in.

A tip here is to view these signals in a scan tool while in park or neutral. The mainshaft sensor should have a reading, while the countershaft should read 0 as seen in Figure 4. If the mainshaft reads 0 while the countershaft has a high rpm reading, the sensors are cross connected. The computer will prevent a reverse engagement deliberately as it thinks the vehicle is moving forward at the time of engagement.

If the selector lever is placed into Drive, with the foot on the brake, both sensors will now read 0 (providing the clutch can hold). With 0 readings on both sensors, a reverse engagement will occur from the drive position.

This error can take place on other transmissions as well, so it serves as a good example and can be picked up on right away. Like Honda's first suggestion in the diagnosis of the P0780 code, get your head around the basics before overshooting the troubleshooting process. The best thing is to properly hook up the wires the first time. *TZ*



Figure 4

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AVAILABILITY: Available

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2:00 pm
3:00 pm
4:00 pm
5:00 pm

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QTY: 2

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AVAILABILITY: Available

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DRIVABILITY



WHAT'S IN THE TANK?

Unless the car is certified as a flex fuel vehicle, adding E85 can be just as bad as diesel to a gasoline-powered engine.

TODAY'S AUTOMOTIVE FUELS COME IN A VARIETY OF BLENDS. USING THE WRONG ONE CAN WREAK HAVOC ON A CAR'S DRIVABILITY.

BY **DAVE HOBBS** | CONTRIBUTING EDITOR

Changes in gas-powered engines have been the norm each year since Nikolaus Otto patented his internal combustion engines in the late 1800s. This past decade has seen automotive technology changing at an exponential rate. One change that often misses the attention of most of us involved in drivability diagnostics is the fuel itself.

Crude Oil: Where It All Begins

Crude oil starts out as a substance made up almost entirely of hydrocarbons. Furnaces sitting next to fractionating

towers heat the crude to more than 700°F. The hydrocarbons begin to boil as the lighter components vaporize. As these lighter vapors rise, they condense on tray-like platforms at various heights.

As engines have become more refined, so has the process of refining crude oil. A process called cracking was developed to break longer carbon string molecules into the shorter six to 10 carbon molecules found in gasoline. Cracking utilizes high temperatures and pressures to accomplish this method of getting more gasoline out of a barrel of oil. The process raised the octane level as well.

Octane — Then and Now

Gasoline actually is a pretty complicated liquid fuel. Since 1995, the EPA has required all gasoline sold to have detergents blended in. Other additives include anti-icing agents, anti-oxidants, anti-wear agents, metal deactivators, corrosion inhibitors and oil soluble dyes to identify grades. The bulk of gasoline can be brought down to two basic concepts: octane and heptane.

Octane is an eight-carbon molecule defined as the fuel's ability to resist knock. Knock is the irregular ignition of the air/fuel mixture in the cylinder.

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der. Normal combustion begins with the spark plug's spark event and spreads out in a uniform manner. During knock/detonation, hot spots of carbon in the cylinder can become other sources of ignition, which in turn cause irregular flame fronts. The end result is a cylinder pressure (and temperature) that spikes up to the levels that result in damage to combustion chamber components, such as pistons, valves and spark plugs. In a compression ignited (CI) diesel engine, the valves and pistons are designed for a more explosive combustion process, but that's not the case in the average spark ignited (SI) gas engine.

Another negative effect of detonation comes with the expanding gasses wanting to send a rising piston back down instead of allowing it to achieve Top Dead Center (TDC) and have a power stroke that actually produces power. On top of that, one of the major contributors to smog — oxides of nitrogen (NO_x) — is produced when detonation occurs.

The other major concept of gasoline, heptane, is a seven-carbon molecule that ignites very easily — just the opposite of octane. In the 1920s, chemists developed a scale that rated octane at 100 and heptane at 0. We still use that scale. For example, if you select 87 octane at the pump you are getting 87 percent octane and 13 percent heptane along with a few other chemicals with varying carbon lengths.

Octane enhancers have been around since the early 1920s with the most time honored being tetraethyl lead from where we got the slogan "fill it up with Ethyl" and the term "leaded" fuel. The lead would attach to the molecules of gasoline and help resist knock. It also was a good lubricant for valve seats.

By the early 1970s, lead was discovered to be a health hazard. Lead poisoning of catalytic converters by the mid-70s and oxygen sensors by the early-80s brought leaded fuel to a near novelty with an ultimate EPA total ban by 1995. Although more advanced forms of cracking and reformulation in the refinement process helped to raise gasoline's

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octane ratings, something had to replace lead as an octane booster.

Methyl tertiary butyl ether (MTBE) did the trick but became an environmental problem.

Not only is it a carcinogenic, it mixes so well with water.

Leaks in underground fuel tanks can contaminate drinking water wells

miles away. This has led to a planned phase-out of MTBE along with billions of dollars in lawsuits and cleanup costs. Twenty-five states have banned the use of MTBE. Ethanol has proven to be a suitable alternative. Many industry insiders are saying E-15 might become the new MTBE.

Though the differences in fuel have become minimal in recent years, octane behavior can be varied. Do you recall seeing those R + M / 2 stickers on the fuel pump? It's the formula chemists use to determine actual octane of gasoline and is an average of two methods of testing octane. The Research Octane Number (RON) method (R for short) measures the octane of the fuel in a test engine with a variable compression ratio under controlled conditions. The Motor Octane Number (MON) method (M for short) is a more precise method that is tested in an engine under a load with variable ignition timing. MON will run eight to 10 points lower than RON.

Which Octane to Recommend?

When considering which octane to use, advise your customers to purchase the octane required by the owner's manual. Compression ratios, variable valve timing, engine temperatures and other factors dictate what octane an engine requires. If 92 octane is more expensive



Replacing a fuel pump? Never a bad idea to perform a post-repair autopsy to be sure you know why it died. Here, debris is clearly visible.

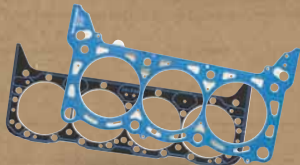
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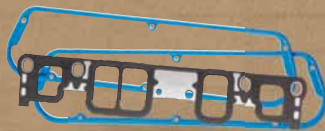
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than 87, would it make sense that it would burn better, contain more energy or get better mileage? The answer is a qualified no. On the contrary, all things equal, using a higher octane fuel than required simply wastes money.

I'll qualify "all things equal." Fuel sold at higher altitudes, Denver for example, runs a point or two below fuel sold at lower altitudes for each grade. The reason is at higher altitudes, the air/fuel mixture will not burn as rapidly (less dense air), therefore knock is less of an issue. If the detergents are at the same

level between regular and premium grade fuel (usually premium grades have more detergents), the engine's carbon deposits are minimal, the engine's cooling system is working to specs and the OEM properly developed the spark curves and knock sensor hardware/software, then an engine will not get any more power or economy with premium fuel compared to regular.

However, if one of those variables is making the engine move towards the detonation threshold causing the PCM to reduce power/economy with ignition timing retardation, you might see increased performance and economy with premium fuel. On the other hand, if the vehicle's spark timing strategy is designed for accommodating multiple octanes, you certainly will see an improvement with premium fuel.

How does that work? Ford is an example of one OEM that doesn't set a spark curve in stone and backs it off when knock is detected. Some Ford engines will increase spark advance up to the level of a knock threshold and then back it back a tad. Put in 87 octane and you will get a spark curve that complements that. Put in 92 octane and you get a more enhanced spark curve.

Not all fuel is created equal. The engine in your customer's car might run slightly better on one of those combinations than another. It's rare, but it happens. Most of the time the difference is a placebo effect (only in their mind), but who are we to argue with a customer who likes XYZ fuel? If premium won't do it, there are plenty of aftermarket additives that enhance octane.

My recommendation is to emphasize the "easy does it" approach to all fuel additives. While there are some good additives we swear by, not every single one of them is beneficial. Some are just plain harmful, many are warranty killers and most are horribly damaging if overused. Octane booster might contain Toluene, alcohol or any number of chemicals that can swell elastomers, emulsify fuel tank plating (creating rust and lead poisoning of cats and oxygen sensors from the tern plating) and cause corrosion throughout the fuel system.

Top Tier Explained

Audi, BWM, GM, Honda, Mercedes-Benz, Toyota and Volkswagen recommend top-tier detergent gasoline.

Those OEMs have stated a common belief that the EPA minimum detergent requirements don't go far enough to keep engines clean. The past 18 years of EPA-mandated detergent requirements have seen a slow but sure decrease in many fuel companies' detergent concentrations by up to 50 percent in some cases.

Detergents are changing as well. Consider the early 1990s before the chemical detergent Techron coming into the market. Fuel injectors were becoming clogged, so fuel retailers put in detergents to clean up the injectors. The trouble with that was some of the detergents being used in part caused deposits to form on the backs of the intake valves on PFI and SFI engines.

There were other sources of valve deposits — namely condensed (and carbonized) crankcase vapors and EGR. These deposits were hard when the engine was warm, but soft enough on a cold engine to absorb some of the fuel mixture (like a sponge) on cold starts. This resulted in hard cold starts, rough/hesitating engines when cold and stalling issues.

Now we have Gas Direct Injection (GDI) engines that don't use an injector pointed at an intake valve; rather it situates the injector directly in the cylinder. The cleanest fuel in the world might not keep valves clean in an engine with GDI. The valves still will get some residual fuel spray inside the engine along with the EGR and PCV deposits. Early adaptations of GDI have encountered numerous complaints of fuel economy and performance degradation. This condition can occur as early as a few thousand miles after leaving the dealer's showroom floor.

Diagnosing Valve Deposits

If you suspect severe valve deposits you have two diagnostic options. The first option is a peek with a bore scope. Prices on these handy little jewels have come down into affordable ranges in the past few years. Your second option would be a little less intrusive but requires a little research if you haven't done it before — Volumetric Efficiency (VE) testing.

Google the procedure; all you need is a scan tool and a VE calculator which can be found on-line or included in ATS's E-Scan. The E-Scan is a PC based scan tool that performs several unique



Ever had a customer add the wrong fuel to the tank?



E85 might be cheaper, but odds are you'll use more of it. E85 has less energy per gallon than gasoline and requires a richer air/fuel ratio.

drivability tests including VE testing. If your VE is confirmed to be lower than specified due to mechanical conditions, it might be time to turn some wrenches to have a look at the intake valves. They might have enough carbon on them to impede the engine's ability to breath. More recent engine adaptations of GDI have seen redesigned PCV systems, internal EGR via variable valve timing and more careful injection timing to prevent sticky intake valve deposits.

Oxygenates

The Clean Air Act of 1990 further changed the composition of gasoline, requiring up to 65 different blends for various regional considerations such as air pollution levels and seasonal conditions. Five separate EPA regulations outline specific requirements for motor gasoline: (1) limitations on lead-based antiknock agents, (2) mandated detergent additives, (3) limitations on the Reid Vapor Pressure, (4) mandated oxygen content and (5) the content of reformulated gasoline (RFG).

The two most common oxygenates are methyl tertiary butyl ether (MTBE) and ethanol. In order to achieve a 2.7 percent required baseline, refiners or distributors must either blend in 15 percent MTBE, derived from natural gas, or 8 percent Ethanol, derived from renewable feedstocks such as corn stover or cellulose. With MTBE almost put out to pasture (as mentioned previously) that leaves ethanol in either ETBE form (Ethyl Tertiary Butyl Ether) or E-10 (gasohol) as the popular oxygenate for regions requiring oxygenated fuel.

Alcohol

Alcohol in the tank of a stock vehicle not designed as a flex fuel vehicle is a disaster. That's why OEMs for years have limited the alcohol in non-flex fuel vehicles to 10 percent ethanol (alcohol produced from grain) and 5 percent methanol.

Ethanol is powerful, too, just not as powerful. Gallon for gallon, gasoline provides, on average (numbers vary with seasonal RVP changes), about 125,000 BTUs of energy. E-85 (85 percent ethanol/15 percent gasoline) only provides 80,000 BTUs of energy. That means it could take you 1.5 gallons of fuel to go the same distance 1 gallon of gasoline will take you. On the plus side, every gallon of ethanol produced reduces

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Suspect alcohol in the fuel? Put your ohmmeter leads in it. Any reading indicates alcohol, since it is conductive while pure gasoline is dielectric.

American's dependence on foreign oil, helps farmers and reduces air pollution.

Even more important than economy, if the fuel system hasn't been designed for alcohol various elastomers can fail along with internal tern (lead solder) plating in tanks that are of the old steel design. Fuel pump failures are common. Current pump gas is limited to E-10 but in the works are plans to plunge the nation into the world of E-15. That extra 5 percent ethanol content doesn't sound like much but it does make a difference. Vehicles built prior to 2001 are likely to have problems of alcohol induced damage to their fuel systems and are exempting from using E-15. Owners of historic cars and motorcycles are naturally up in arms over the move. The president and CEO of the American Automobile Association (AAA) Robert Darbelnet made news speaking out about the problems of E-15 last fall.

We've all had this scenario in our shops, asking the customer, "Why did you pump E-85 in your non-flex fuel vehicle?" The truthful answers? "It's cheaper." "I thought it wouldn't hurt." "It was an accident." Sometimes we don't get truthful answers. Sometimes the tanker refueling the retailer screws up. Diesel goes in the gasoline in-ground tank or E-85 goes in the 87 octane tank. How can you tell if your customer's non-flex fuel vehicle has been dosed with E-85? The answer might be simpler than you think.

Contaminated Fuel Diagnosis

The wrong fuel won't burn well or at all in an engine. Period. Your sense of smell is your quickest test. Next is your scan tool. Fuel trim numbers will be positive (if the engine even runs), indicating there needs to be more fuel due to the fact (in this scenario) the fuel in the rail isn't allowing for good combustion. Lean codes might be present. The engine might have enough fuel trim adaptation to actually run decent or could lean out so much at wide open throttle (WOT) that something bad happens inside the cylinder. Some flex fuel vehicles use a sensor in the fuel line that monitors the fuel's alcohol content. The PCM reads this percentage and adjusts the fuel injector on time to compensate for the less powerful fuel.

Other flex fuel vehicles monitor fuel trim changes when the fuel tank's sending unit indicates there has been

fuel added. If the trim goes up and the only thing that happened (in the PCM's mind) is fuel being added, there must be alcohol in the fuel. If a flex fuel vehicle in your shop gets a PCM re-flash, the old learned alcohol percentage resets to zero. You either need to drain the tank and put in straight gasoline or test the alcohol content yourself and reset the PCM to that percentage with a scan tool. Finally, there are tests for fuel problems. You could send a sample to a chemist, but here's how you test for water contamination and/or alcohol content.

1. Retrieve a measure of fuel from the effected vehicle and allow it to settle for 15 minutes.

2. If a separation line is present there is water present in the fuel.

3. Pour eight units (cc, ounces, ml whatever unit you like) of sampled gas in a container accurately marked.

4. Add two units of water to the sample. Apply lid and shake. Allow to settle for 15 minutes.

5. If the fuel sampled is straight gasoline a separation line will form at the two-unit mark.

6. If the fuel separation line is above the two-unit mark, there is alcohol in the fuel. The difference of where the separation line should be and where it is gets divided by the total volume of what you are testing and that becomes your alcohol content percentage. Easy enough?

Alcohol absorbs water and alcohol will mix with gasoline so it almost appears the alcohol gets rid of the water. It doesn't; it just suspends it. This essentially is how gas line anti-freeze works. Comprised of isopropyl alcohol, the fuel line anti-freeze prevents water from accumulating at the bottom of the tank by suspending it and allowing it to flow with the gasoline /alcohol mix to the engine to be burned. **ZZZ**



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

Email Dave at david.a.hobbs@delphi.com



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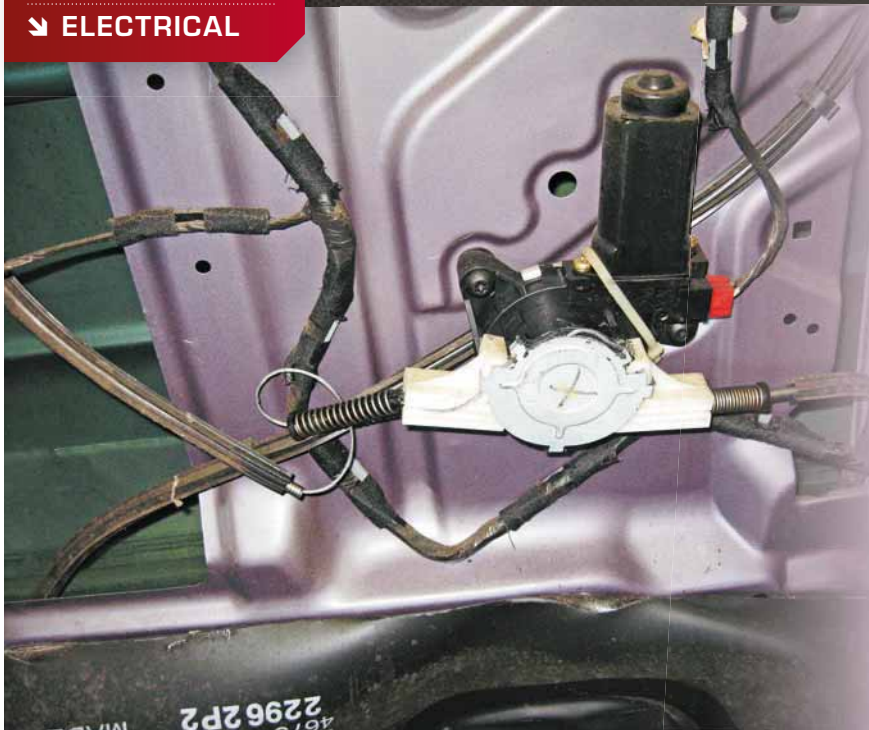


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TECHNOLOGY

ELECTRICAL

MORE THAN UP AND DOWN



This 1996 Dodge Caravan has a visible motor (usually they're hidden from view) and two window tracks instead of just one like most power windows nowadays, probably because the door and the window are so long.

FAILURE TO GO UP OR DOWN IS NOT THE ONLY FAULT TODAY'S POWER WINDOWS CAN SUFFER.

BY RICHARD MCCUISTIAN | CONTRIBUTING EDITOR

My dad drove a lot of different cars home from his garage. One morning in 1963, I remember looking down the long dirt road in front of our house at the approaching school bus, and I glanced over my shoulder at Dad while he slid behind the wheel of a long black car to leave for work. I still don't know if that grand old boat was a Cadillac or a Chrysler, but I do remember the goose bumps I felt when I saw all four of the windows slide down into the doors under their own power.

When I was 6 years old, it seemed more like magic or science fiction than reality. According to some sources I found online, Daimler first introduced electric windows in 1948, but the SAE timeline credits Lincoln with the first power windows in 1946.

My wife is a drive-through bank teller, and she says one in four of her cus-

tomers have a driver side front power window that is inoperative; they have to open the car door to do business. Any shop owner knows there's a big profit in power windows.

The old scissor-type regulator with its curved rack and spiral spring were by no means trouble free, but they didn't drop like flies the way so many of the cable and pulley units do nowadays, either. Usually all it took on those units was a motor or a switch. That being said, those units do tend to bind up as the door housing gets tired. The cable and pulley units are easier to service, and from the design side of things, they're a lot easier for automotive engineers to work into a variety of door shells.

For my purposes as a technician at the Ford/Jeep dealer, I'd operate the switch on a dead glass and watch the dome light or the instrument cluster voltmeter. If it reflected a heavy bat-

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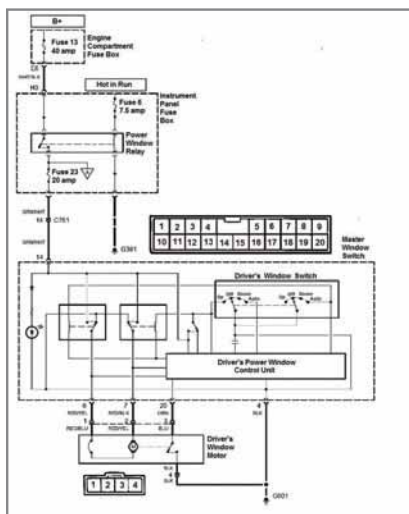
tery draw while I was trying to get the window to move but the window didn't respond in the desired direction (down if it was all the way up or vice versa), that generally meant the switch was working and the circuit was complete, so a motor was in order. In those cases, removing the door panel and banging the inside of the door really hard sometimes will unbind the motor.

If that doesn't work, you simply can remove and reinstall the motor on a scissor-regulator equipped door would un-jam things for a temporary fix. But that's all it was. Those just about always came back. Running one of those jamming scissor-types down all the way tends to render it inoperative. I once replaced the regulator and the motor in one of those and the new one seemed to work fine for a couple of weeks and then jammed the same way

Photos: Richard McCuistian

the old one did, indicating a problem with the door itself.

If, however, operating the switch doesn't dim the dome light, then there's an open circuit somewhere. Nowadays, almost invariably, what we have are cable and pulley regulators with a motor that still runs, but the regulator it's bolted to has become a tangled mass of junk. The most odious circumstances revolve around a window that's down and won't go up in a rainstorm or in cold weather. Like a bad timing belt, those failures don't generally pick a good time to happen.



The 2004 Honda Civic driver's side window has an integral control unit and two relays to operate the driver side power window for auto down function. Notice the motor is a four-wire unit: the second pair of wires feeds a pulsed signal to the control unit for auto-down function. No initialization procedure is listed for this system. Presumably, the control unit simply looks for the pulses to stop and uses that interruption to stop driving the window when it stalls during downward travel. The power window relay in the instrument panel fuse box provides B+ voltage to all the window switches but only in the key on and start positions. Notice also that there are 3 different fuses that can kill the power windows and the all-too-familiar circuit breaker integral to the motor.

Troubleshooting becomes more challenging when you factor in the solid state one-touch-down box or body computer (whatever applies), though those little rascals are generally pretty reliable. Some newer vehicles (like the 2006 Sonata) actually have one-touch up windows. That sounds pretty dangerous, doesn't it, sort of like a glass guillotine? Not so on the Sonata. Those windows are kind of like your garage door; they stop and reverse direction if the window opening is obstructed before it reaches the top of its travel, and there are multiple safeguards built into the ECU programming.

Pricing the Repairs

Motors and regulators obviously aren't the only problems with power windows, though they're generally the most expensive repairs. I say generally, because some Japanese cars can have pretty expensive switches. At the time of this writing, I found that the drivers side switch on a 2004 Camry lists for \$356.67 (the regulator is only \$101 and comes separately from the motor, which is \$280). The same switch for a 2001 Jeep Cherokee lists for \$139. A 2001 Mazda 626 driver side switch runs just more than \$300, but that same switch for a 2004 Six is only \$104. Go figure.

On a 2004 GMC Envoy without heated seats, the driver side switch is \$229.83 (the driver's window motor is \$115). Regulators are all over the place, from a little more than \$100 to well over \$300 on most of the cars I checked. Volkswagen switches and regulators tend to be less expensive, but the window motors on a 2001 VW GTI are \$319.

Speaking of German cars, the window regulators, motors and switches on Mercedes automobiles are very reasonable, usually costing only a fraction of what those parts sell for on Japanese platforms. The window regulators on Jaguar automobiles run from \$600 to \$700, and the motors can be about \$50 on either side of \$500. This could go on for awhile, but you get the picture. Fixing the power windows on some cars can be more expensive than a salvage yard engine for the same car.

Ford power window motors that drive those old spring-and-scissor regulators have breakaway gears that are prone to give out. When I operate



These two-track regulators can be confusing at best, so it's a good idea to get the new one in hand and note the configuration and routing of the cables before diving headfirst into the job. Notice that this Dorman replacement (just more than \$100) has a pigtail instead of an integral connector. This doesn't hurt a thing, but be careful to keep the extra wire out of trouble.



The original regulator had become uncabled, as they usually do. This one went first, then the right front went. We decided to get those two replaced before the other two failed. These regulators are a lot quicker and easier to replace than the old scissor-and-spring type.

the switch for a particular window, hear the motor running but not moving the window and making that bumping noise, I know the gear is shot. While they weren't available initially, nowadays, aftermarket gears can be bought at the dealer parts counter as well as at most parts houses. Further, the gears aren't that expensive (about \$20). They're fairly easy to change, but the labor charge is about the same as replacing the motor.



Read this blog on an interesting failure of a Toyota Sequoia rear hatch caused by a failed sensor in the tailgate. MotorAge.com/sequoia

To do that on an older Ford, just yank the door panel, look in the general area where the motor is located, and you'll find three center punch marks that correspond with the screw heads that hold the motor in place. You'll need a 3/8-inch or larger drill bit to make a hole big enough to egress a 1/4-inch drive 5/16 socket. After you drill out the center punch marks, just look through the holes and there are the bolt heads. Sometimes you'll have to remove the

door speaker to get the motor out.

The bumping and thumping that comes from those failed Ford gears results from the fact that the outer gear and the inner gear no longer are turning together. The little plastic pucks that marry the two-piece gear together

tend to crumble, and they look as if they are designed to do exactly that, possibly in case of an overload situation, but I've never seen that in writing. The helical outside ring gear on the business end of the window motor is driven by a worm gear to provide the necessary torque to raise that heavy glass (albeit with that powerful spiral spring adding lift), and the inner pinion gear meshes with a curved plate that is a part of one side of the scissor regulator.

We fix quite a few power window problems in my automotive department at the college. Late model GM cars have lots of power window problems, and at the dealership, it generally costs about



Moisture barriers like the one on this mid-90s Mitsubishi Montero are the first thing you see when you pull a door panel on a previously untouched vehicle. They were made of special paper on older cars, but were upgraded to plastic about 20 years ago. And while it's very tough trying to peel one out of the way without destroying it, the barrier is really important, so do what you have to in order to seal it up again like this when the job is done, even if you have to repair the torn barrier with packing tape.



This was one of two regulators we had to replace in a 2002 Trail Blazer. While we ordered the left rear regulator, we got a right rear one to start with, and it took the parts guy at the local Chevy dealer three more attempts before he got us the correct one. The part number kept changing and what he kept sending wouldn't fit.

HYUNDAI SONATA DRIVER SIDE POWER WINDOW

When driver door power window auto-up switch is operated on the Sonata, the "Safety Function" is activated.

When the ECU detects the force of 100N (Newton Meters) during the window rising (4 mm to 25 0mm from the top of the opening), the window is reversed until 300 mm (12 inches) from the top of the door. The Hall Effect Sensor provides input to the ECU on the position of the glass. Notice that there is a lot more to this power window lift unit than just the motor.

When the battery has been disconnected for more than 5 minutes, the safety power window motor may need initializing. Power window operation before initializing is as follows:

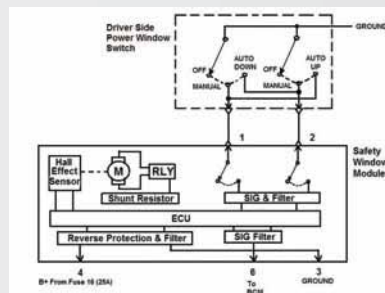
- Manual-Up/Down function is available
- Auto-Up function is not available

Initializing the window motor: Start with the window in the full open position, raise the window, holding the switch in window, full-close position over 0.2

second. If you don't start in the full open position, this probably won't work.

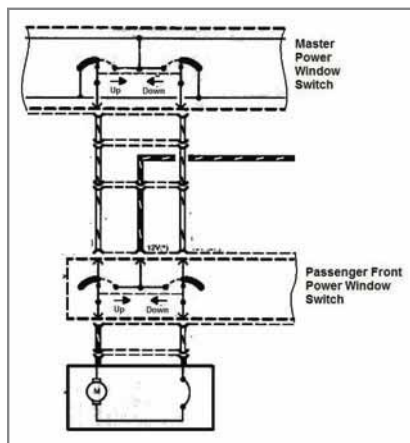
Note: If you initialize the safety power window with the glass jammed, safety function will not be available.

Fail safe mode initializes when the window is forced to move by something other than motor operation - the ECU knows from the Hall Effect switch input that the glass is no longer where it should be. At this point, the ECU enters fail safe mode for user's safety. In Fail Safe mode, the window will go down but it will only go up 20 millimeters at a time.



\$400 per door to replace the regulator, which comes with the motor, but it's a bolt-in part instead of being held by rivets like the Crown Victorias and rear door regulators on late-1990s Ford Explorers. For awhile, Explorers used the scissor-type regulators in their front doors and the cable and pulley units in rear doors. Late-90s Dodge Caravans have cable and pulley units, but with two tracks instead of one, and they can be a bit confusing to figure out if you aren't paying attention when you snatch the old one.

Crown Victoria window regulators are the same type but are available



Power window switches generally are wired in series the way you see here. For that reason, a bad driver side switch in the master power window switch assembly can cause the passenger side window motor not to work from either switch. Both wires feeding the motor should show ground whenever both switches are at rest. If either wire doesn't show ground, check the wires coming from the master switch. If they both show ground on the incoming side of the passenger switch, then the passenger side switch is faulty. If, on the other hand, there is no ground being fed to the passenger side switch from the master switch and the wires are good, the master switch is faulty. Remember now, if either wire is shorted to ground, the window will work, but only in one direction. I've seen that a time or two.

from aftermarket sources (like Dorman) for a fraction of what it costs to replace a GM regulator, and Dorman is making more and more replacement regulators available all the time. One example of a fairly recent Dorman release would be the front window regulators on some Chevy Trail Blazers.

If a power window regulator is riveted in, there's no good reason not to rivet the new one in. The plastic insulators that go on either side of the door glass where it attaches to the regulator on a Crown Victoria are available from Ford. The outboard insulator has a big metal washer built into it and the inboard one is all plastic. But when you buy a pack of each, one pack comes with eight pieces and the other pack comes with seven. I'll never understand that, because they're always replaced in pairs. And by the way, removing the glass from the door is a must when replacing a cable and pulley regulator.

“Ford power window motors that drive those old spring-and-scissor regulators have breakaway gears that are prone to give out. When I operate the switch for a particular window, hear the motor running but not moving the window and making that bumping noise, I know the gear is shot.”

The Other Problems

Then there are those times when we're blind-sided by motors that need initializing, like the rear windows on Explorer Sport-Tracs. Those aren't plug and play, so dig out the shop manual if you have to replace one. We did some work on a 2007 Toyota Avalon a few weeks back and found that the sunroof goes offline until the windows are reinitialized, a process that is simple once you've done it but impossible to figure out if you haven't. It goes this way:

1. Operate each window from the



In a situation where the parts have to be ordered but the customer needs to drive the vehicle, the window usually can be propped up like this with a piece of PVC pipe cut to the right length and notched on the top end to receive the glass. Notice we wire-tied this one to the door to keep it in place.

respective switch. From full up, roll the window all the way down and then all the way back up. At this time, the driver's door power window switch illumination blinks.

2. Push the driver's door power window switch and lower the window halfway.
3. Pull up the driver's door power window switch until the window closes, and continue to hold it up for more than one second. At this time, the driver's door power window switch changes from blinking to constant illumination.
4. Check for the proper operation of the one-touch open and close function by fully pushing the switch down once and fully pulling the switch up once.
5. Repeat steps two through four on each door's power window switch.
6. Check that each door's power window switch light is on.

Dad's Chrysler might have seemed like sci-fi, but today's cars give new meaning to the term "Rise of the Machines." *ZZZ*



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TECHNOLOGY

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PREPARING FOR OLD MAN WINTER

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NO MATTER WHERE YOU LIVE, THERE ARE STEPS YOU CAN TAKE TO HELP YOUR CUSTOMERS PREPARE FOR THE CHANGE OF SEASONS.

BY **PETE MEIER** | TECHNICAL EDITOR



Barrow, Alaska, generally is recognized as the coldest spot in the United States. Its average temperature is a balmy 11.7° F and has a recorded best low temperature of -56° F. On the other side of the coin, the world record for high temperature is 134° F, and a few cities in California were close to breaking that mark during the heat waves experienced this past summer. And while this article is going to talk about preparing for the low side of the scale, many of the tips shared apply equally to hot or cold climates.

Let's Start With The Battery

A battery provides electromotive potential via a chemical reaction, and that reaction slows as temperatures drop and increases as temperatures rise. Compared to a standard tempera-

ture of 77° F, a battery that hits freezing will typically produce 20 percent less energy, and at -22° F, the capacity can be cut in half.

But it's not just the cold. According to a 2010 Battery Council International (BCI) failure mode study, even though batteries have become more heat tolerant over the last decade or so, heat still can have a drastic impact on the life of the battery. Back in 2000, a change of just 12° F took roughly one year off of the battery's estimated lifespan. In 2010, it takes a 22-degree change to have the same impact. Overall, improvements in battery design have resulted in an average lifespan of roughly 55 months (compared with an average of 41 months during in the 2000 study). And you might be surprised to learn that batteries in the South are used up (with an average of

47 months) long before their northern cousins (averaging 59 months).

To help make sure your customer's battery will deliver as promised, perform a complete battery/charging system test. All you need to do a complete set of tests is a digital multimeter (DMM) and an amp clamp.

Start by measuring the Open Circuit Voltage (OCV) of the battery. A fully charged battery with healthy electrolyte should read 12.66 volts (2.11 volts per cell). This is an indication of the state of charge of the battery. If your meter reads more than 12.8 volts, there is a surface charge on the battery. This also can tell us something about its condition. Surface charges higher than 13.5 volts or so can indicate that water has been depleted from the electrolyte, due to evaporation or overheating.

Photos: Pete Meier



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If the fluid level has dropped low enough to expose the plates even a little bit, it's a good idea to replace the battery. If the plates are still submerged and you can access the cells, use a syringe to add water (distilled only, please) to just below the vent well. A reading of 12.5

volts or less indicates a battery that is discharged more than 20 percent, and you must recharge the battery before proceeding with a load test. An OCV reading of less than 10.5 volts indicates a shorted cell and the battery should be replaced.

Be sure to test the battery connections. Look for (and clean) terminal corrosion and the battery case. Corrosion on the terminals usually is caused by outgassing of the electrolyte and might indicate a leak in the battery casing. Dirt and grease on the case (if it forms a path between the posts) can be a source of battery drain and accelerate the wear and tear on the battery.

Perform a voltage drop test on both the positive side of the starter circuit (one lead at the positive post and one lead at the end of the starter cable where it attaches to the starter) and on the ground side of the same circuit (one lead at the negative battery post and the other on the starter case). Be sure to have an assistant crank the engine while you're testing. Voltage drop tests must be done with the circuit on. Correct the cause of any excessive drop found.

The next step is to perform a cranking voltage test. Unlike a carbon pile load test, this test only applies a load to the battery for a few seconds. With your DMM still connected, turn on the meter's record (or MIN/MAX) feature and crank the engine. Repeat the process three times, allowing the engine to run for a few extra seconds on the last cycle before turning it off. Your minimum reading should be above 10.0 volts (as opposed to the 9.5 volts for a 15-second carbon pile load test). Anything less than 10.0 volts indicates a battery that has reduced capacity.

Performing routine maintenance? Improve what you do by watching this free video, one of our The Trainer features
MotorAge.com/oct11trainer

But before you recommend a replacement, be sure to consider the battery's temperature when you tested it. If it didn't meet 10.0 volts while it was still in the 70s, you certainly are doing your customer a favor when you recommend a new one before the weather drops to the 20s.

Now check your meter's MAX recording. This is charging system voltage and should fall between 13.5 and 15.0 volts. Refer to the OEM service specifications for your specific vehicle, as some cars use intelligent charging strategies that initially charge at a higher rate than you may be used to seeing.

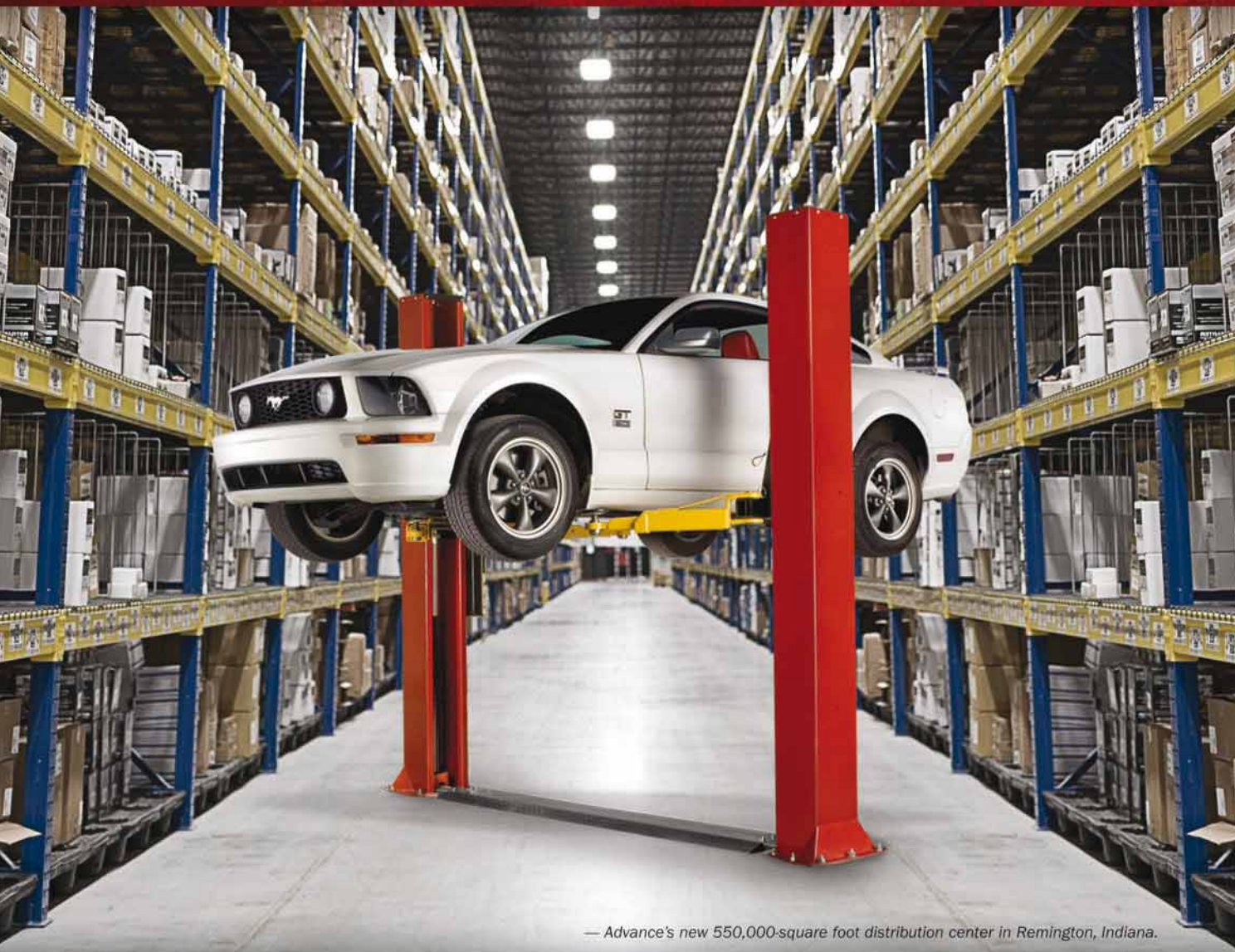
The last test is the battery recharge current test. This is where you'll need an accurate amp clamp. When the engine is started, the battery is temporarily depleted. As soon as the engine begins to run, the alternator comes on line to replenish what was lost. Initially, the NET current (the total difference between system demand and alternator output) flowing into the battery can be substantial, but it should only take a few minutes (allow five) for a good battery to recover.

The NET current flow then should drop to less than 10 amps (some sources say 3 amps). The lower the number, the better it is for the health of the generator. If the number remains high



This alternator might be rated for 110 amps, but it is not designed to deliver high current for an extended time. Test the recharge current as part of your overall charging system analysis.

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The battery might start the car fine while the weather is warm, but any weakness in it will be magnified when the mercury heads south.

(caused by an internal fault in the battery, typically sulfation), the generator can overheat and fail.

Coolant

Coolants provide important protection for the engine and, on hybrids, for the high voltage electrical systems. Well, the water does most of the cooling. The coolant is added to the water to enhance both boil-over and freeze points. In addition, inhibitors in the coolant protect system components from corrosion and erosion. With all the important work coolant has to do, don't rely on a simple visual check of the coolant bottle's fluid level alone.

We can, though, start there. Check both the level and condition of the coolant in the reservoir. Low levels happen for one reason only: leakage. So if the level is low, be sure to determine why

it's low and correct the problem. Low coolant levels promote air in the system, and coolant can't protect what it can't touch. Debris in the tank, too, can come from only one place and are evidence of a cooling system receiving less attention than it should have.

Next, check the water/coolant mix with (in order of preference, best to worst) a refractometer, test strip or gauge-style hydrometer. No ball-type hydrometers, please, and take your sample from the system and not the reservoir. A coolant mix in the 40 to 60 percent range is considered acceptable. Follow up that check with a check of the pH, or acidity, of the coolant. The pH is an indication of the health of the inhibitors. Typically, the coolant will become more acidic as the inhibitors drop out. If the coolant passes this test as well, your customer's coolant should be ready for the winter ahead. On the other hand, if the coolant is too acidic (or too alkaline), a coolant flush and refill with fresh coolant is needed to insure system protection.

A couple of notes on cooling system service for you. First, water makes up half of the mixture, so be sure to use water that meets specifications for both the flushing procedure and for the refill. There are test strips you can buy to check your shop's water supply, and you should do it periodically to make sure it's OK. But the water in your shop is drinking water and is not suitable for use when mixing up the refill. Why? It is oxygenated to make it taste better,

and that same oxygen can lead to wear and tear in the system. For your 50/50 mix, use distilled water or buy coolant that is pre-mixed from the factory.

Second, coolant color is not indicative of the type of coolant in the system. Follow the OEM recommendations when selecting a replacement product. Third, coolant service intervals can be as high as 10 years or 150,000 miles for some makes, but that's in a perfect world. Even extended life coolant can be worn out prematurely if the wrong water is used, air is prevalent in the system, leaks have been left alone and by a dozen other ways.

Of course, check over all the underhood fluids as well as the condition of the belts and hoses while you're under there. Watch our coolant service webinar (on YouTube or in the AutoPro Workshop) to learn more about testing and identifying the causes of premature coolant failure.

Tires

Snow tires will be the norm in many parts of the country, and many drivers have a set mounted and stored to make the swap a simple one. Or is it? Changing tires on late model cars can impact the operation of a variety of safety systems — antilock brakes (ABS), traction control (TCS) and electronic stability control (ESC) for example. It also can impact the operation of the transmission with many models requiring you to tell the control module in charge what changes you made.



(Left) Coolant test strips can be used to test coolant mixture and acidity, the two key factors you need to determine whether or not the system requires service. (Right) Even when it's cold out, the air conditioning system has a job to do. Check the operation of both the A/C and heating systems to make sure your customer is ready for the winter ahead.



It can get hard to see in a snowstorm or heavy downpour, and clouded headlight lenses don't help. This service is easy to perform and of real value to your customer.

And there's the tire pressure monitoring system (TPMS) to consider. Will you take the sensors out of the summer wheels and install them into the winter ones? Or will you install one of the aftermarket clone-able sensors in the winter wheels? Clone-able? Yes, these are sensors that can mimic the originals (either through direct programming or preprogrammed), allowing you to install them in a set of winter wheels and then simply install the tires on the car. The TPMS control module thinks it sees the same sensors as it saw in the summer wheels, so no relearn is necessary.

Be sure you review the OEM service information regarding all of these possibilities before agreeing to a simple swap for your customer. Make sure you have the tools, service information and parts you'll need to do this "sim-

ple" job properly. You can find all the resources you need, including several instructional videos, on our web site. And don't forget to change out that stale air for fresh air before installing the winter tires. After all, they've been sitting in the corner of his garage all summer long.

OK, you do know I was kidding about that last part, right?

A Few Other Checks to Make

Now also is a good time to make sure the Heating and Air Conditioning (HVAC) system is working properly. On many cars, the air conditioning system is used in defrost mode (regardless of temperature selection) to dehumidify the air and help prevent the window from fogging up. Hook up the pressure gauges and check the operation of the A/C system.

Once you've verified the A/C is blowing cold and is coming out of the right ducts, crank the temperature control down to full heat and complete your performance inspection there. A lack of heat can be caused by air in the cooling system, a temperature blend door that is not functioning or restrictions in the heater core flow.

Often overlooked is the cabin air filter. Once fitted to only higher-end cars, cabin air filters are the norm on more than 85 percent of the cars made since 2006. They not only keep the outside dirt, pollen and smog out of the cabin, they also help prevent debris from building on the evaporator core. Clogged filters can reduce the airflow through the vents and on some occasions have been respon-

sible for the early demise of an A/C compressor.

Another overlooked item is the wiper blades. It seems our customers know full well they are worn and streaking the windshield, but then forget all about it once the weather has cleared. Visually inspect them for damage, then hit the washer function and see how well they clean and clear. While you're focused on the wipers, make sure the wiper wash bottle is full of washer fluid. It, too, resists freezing. If all you see is water in the tank, advise your customer of the potential damage it could do to the washer motor. A small part but not always the easiest (or cheapest) to get to and replace.

What about the lights? Where I live, there is no mandatory state inspection, and I see more cars with brake lights that don't work than I do with lights that are totally functional. With inclement weather, the need to see and be seen is vitally important to the driver's safety. Make sure all the lights work, including the brake lights.

Check the condition of the headlight lenses. Clouded lenses reduce the light getting to the road and the fix is easy to do, using any of a dozen different products on the market. I used to use No. 400 grit sandpaper (wet) to get rid of most of the haze, followed by a fine polishing compound to get rid of the rest. The key to a successful headlight reconditioning is the use of a sealant afterward to protect the lens from hazing over again.

Your customers count on you (whether they admit or not) to keep them safe and to help them be ready for the seasons ahead. A little more focus on these key items can help you differentiate your shop from your competitors, winning you more business in both the short- and long-term. **MA**



Serpentine belts can look fine and still be worn out. Most belt makers offer these pocket tools to check EPDM belts for damage. This one is Dayco's version.



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

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GOING TO THE EXPERTS

BY LUCK, A TOP TRANSMISSION EXPERT WAS IN TOWN TO ADVISE THESE GUYS. THAT'S GREAT TIMING FOR DEALING WITH THESE TRANSMISSION PROBLEMS.

BY "G" JERRY TRUGLIA | CONTRIBUTING EDITOR

Do you shy away from customers that come to you with a transmission complaint? Today, nearly everything on the car is electronically controlled, and the transmission is no exception. Sometimes, as POWERTRAIN PRO Publisher and ATSG President Wayne Colonna shares, problems on the drivability side can cause issues on the transmission side, and vice versa.

Recently, two vehicles came in to the Car Clinic bays (home of our TST webinars and the classrooms of ATTS) with transmission complaints. Let's learn right along with lead tech Alex Portillo (who shares his experiences here) and perhaps you'll be less reluctant in the future to tackle these issues.

First, a 2003 Volvo S60

Before I get started telling you about the transmission problem, I would like to share my memory of this vehicle with you. It might be helpful information should you experience the same problem. This Volvo was in about six months earlier with an owner complaint of the instrument cluster not working. While performing my diagnosis, I found that all vehicles systems

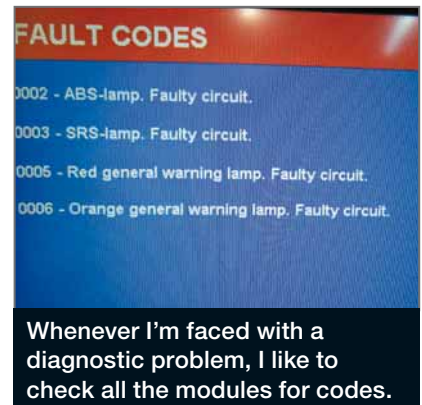


This Volvo customer was one we all have: a price shopper looking for the lowest cost.

were Diagnostic Trouble Code (DTC) free, and the only problem was a cluster that was dark and not working.

With an AutoLogic scan tool attached, I was able to communicate with the cluster, but the dash gauges and lights would not work. I also should tell you that in addition to the gauges and lights, this cluster utilizes an information display that was not operational. We suggested to the vehicle owner a new cluster and cluster configuration in order to get everything back to normal, but the vehicle owner declined to repair the vehicle.

Moving on to why I had this Volvo back in my service bay, there was a new customer concern of a transmission shifting problem. The first thing I noticed was that the cluster was now working, but the dash information window had an SRS (restraint system) message displayed. (Remember this information as you read on about the transmission shifting problem.) My diagnosis started with a test drive



along with a scan of the vehicle computers to see if it would reveal any clues leading to the transmission shift problem.

This Volvo looked like it was going to be difficult to diagnose, because the owner replaced the dash cluster with a used part at a different shop and likes to bounce from shop to shop, looking for the cheapest estimate. (That never happens, right?) Suddenly I realized this problem was not going to be as bad as I thought, because the transmission expert, Colonna, was in the building.

He was up here working with TST on a webcast called "Drivability





Luckily, Wayne Colonna was in town when I had this Explorer to diagnose.



Even though this cable had popped off, the shifting problem wasn't corrected until I fixed the O₂ heater code.

Meets Transability," so today really was going to be my lucky day with expert help in the house. (**Editor's note:** Watch that webinar in its entirety on the TST YouTube channel or in the *Motor Age AutoPro Workshop*.) Because I don't rely on others to diagnosis problem vehicles for me, I decided to proceed with my diagnostic game plan. Without any assistance, I continued on and found that this Volvo had the following problems: hard shift going into drive, late 2-3 shift and a loss of drive for a few seconds.

I checked for Technical Service Bulletins (TSBs), made sure that the Transmission Control Module (TCM) had the latest flash and that there were no transmission or engine DTCs. I scanned the complete vehicle and located an ABS and SRS DTC, not thinking that I had to be concerned with them since they are not normally the cause of a transmission problem. My first plan of action was to perform a TCM adaptation, knowing that my previous experience for this type of problem was resolved by doing so.

When I connected the AutoLogic scan tool to perform the TCM adaptation, it did not progress as it usually does, and I wasn't sure if it was working or not. While I was in the process

of the adaptation, Colonna came out into the shop and asked me what was wrong with the Volvo. I explained the shifting problems and told him I was concerned about the adaptation process because it displayed "Active" on the screen for longer than normal. He suggested that I clear the DTCs from the ABS and SRS then try the Adaptation again.

The transmission expert was right. In this instance, you can't have any active DTCs present while performing an adaptation. After I cleared the DTCs and message on the cluster, I tried the TCM adaptation again. Now successful, the transmission problems were resolved along with the SRS DTC. It was a different story for the ABS DTC that came back on during the test drive. So the moral of this story is that any DTCs or messages in the instrument cluster display have to be repaired (for the Volvo anyway) before the vehicle is able to accept a TCM adaptation.

"If there is a problem with one of the oxygen sensors it could affect transmission shifting. I decided to take a look at the wiring schematics and trace the wiring to see if they share any connections."

Next, a 2001 Dodge Dakota

While Colonna was in town, I had another problem vehicle, this time a 2001 Dodge Dakota 4x4 3.9L V6 with a 42RE transmission. It came in with a complaint of a hard first shift. I started my diagnosis with a scan of the vehicle computer systems (I do this on all of my diags) and came up with only a rear oxygen sensor code PO136 (O₂ Sensor Bank 1 Sensor 2 heater malfunction).

Colonna, being the helpful guy he is, explained to me that the oxygen sensors on some vehicles might share feeds that have a connection to the transmission. He went on with his explanation in more detail, saying that if there is a

problem with one of the oxygen sensors it could affect transmission shifting. I decided to take a look at the wiring schematics and trace the wiring to see if they share any connections.

After tracing through the wiring, I told Colonna I was unable to find any shared connection. He continued on with his explanation, telling me that the system internally shares something in common on the multiplex circuit. My next step at this point was to disconnect the oxygen sensor wiring and take it for a ride to see if the shifting problem still existed. Unfortunately, the shift problem was still present, having me second guessing myself, thinking that I might have done something wrong. But what?

I pulled the Dodge back in and lifted it up taking another visual of the transmission and O₂ wiring, only to find that the shift cable for 1st and 2nd gear was not connected. I guess when I replaced the transmission a few months earlier, I probably did not press the shift rod clip in all the way and it worked its way loose. I now clicked it back in place and took the vehicle for another test drive to see if the transmission shifted correctly.

By now you might be thinking about the explanation of the O₂ sensor circuit causing the problem. Well, being the curious tech I am and knowing that Colonna knows transmissions inside and out, I decided to reconnect the bad O₂ sensor wiring and go for another test drive. The result of this test drive was that the shifting problems were back again, confirming that there was a relationship between the O₂ heater circuit and transmission. I finally fixed the vehicle when I replaced the O₂ sensor, and confirmed the repair by performing a test drive and sufficient to complete the related O₂ monitors. **TZ**



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

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COUNTRY SHOP DAY

WITH A FEW DAYS OFF WORK, ONE WRITER LOOKS AT LIFE IN THE SHOP OF AN OLD FRIEND.

BY RICHARD MCCUISTIAN | CONTRIBUTING EDITOR

One recent week, I visited two country shops where I've placed grads, and both shops are well-equipped and busy. Elite Automotive is a shop where you're just as likely to have a Bobcat front-end loader in the service bay having the tracks replaced as you are to see a Chevy pickup in for a clutch job or a 2009 VW in for an engine swap.

Among the many vehicles waiting for service on the lot was an ancient fire truck that rolled off the line before WWII. One guy had just replaced the engine in a 2009 Jetta with a salvage yard unit (customer's choice) and it ran just fine after the swap until it started knocking, so all that work would need to be done again.



HOT PROBLEM

2007 FORD EDGE

Vehicle Year/Make/Model

3.5L V6

Engine

6F50 AUTOMATIC TRANSAXLE

Transmission

98,851

Mileage

A/C DOESN'T COOL

Vehicle complaint

The other country shop I visited was Bay Springs Auto, another busy country shop owned by Donnie, a friend of mine who has been in business at this same location for seven years. That's where I spent the day working with and observing Matt, another one of my grads, who has been employed there for a couple of weeks. Donnie was just finishing up a vintage 1968 Mustang in which he had upgraded the powerplant from the original hot water six banger to a crisply rebuilt 289, complete with throttle body fuel injection and plenty of chrome.

The owner had purchased that 289 engine after having heard it run and had taken it home, planning to bring in both the car and the engine when it could be worked into the flow. He called Donnie and asked if it would be OK to replace the oil pan and valve cover gaskets and maybe clean the engine up a bit, and Donnie told him it would be fine. Two months later, with the beautiful freshly painted gold Mustang and the vintage replacement V8 engine finally at the shop, it turned out the engine was locked up.

Upon interrogating the customer, Donnie discovered that while guy had the engine oil pan and valve covers off, he decided to wash everything he could see with dishwashing detergent and a water hose. The end result was predictable – the engine that was run-

ning right before he bought it was now scrap iron in need of reconditioning. Well, in truth that wash job wasn't such a bad thing, because he did get a fresh rebuild, even if it was a pricey one, and this cream puff of a Mustang deserved it. The guy even got a sequential turn signal kit installed. This was a beautiful machine when all the work was done.

Air Flow Issues on an Old C1500

In Bay Springs' service bay No. 1 sat a faded blue 1988 Chevy pickup with a brand new A/C compressor installed but with lousy airflow into the cab. Another tech, Ben, removed the blower for a rat's eye look at the evaporator core, which is hard to see without a mirror or a borescope. With Donnie's Snap-on scope fired up and the probe peeking up through the blower hole into the evaporator case, it was evident that leaves and dust had been making their way into the fresh air vents for decades. There was probably a pound

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Photos: Richard McCuistian

of dust and a cigar box worth of leaves nestled up to that heat exchanger, and it needed hosing.

The good news was that the old truck had rubber mat in the floor instead of carpet, so it was parked on the sloping drive where some creative water work was applied to clear the core and case of dust and leaves, with some of the water going out the evap drain and some running out of the truck's floorboard and off the edge of the concrete. The owner couldn't care less if we got his rubber mat wet, he just wanted to cool down on these humid, 90-degree South Alabama days, even if it has been cooler in Alabama this summer than any in recent memory.

This truck had intermittent oil pressure gauge problems (lifter clatter was never heard even when the gauge was down), and the owner opted to hire the shop to pop a 2-inch lighted gauge under the dash. Donnie opted for an electric one so as not to pipe oil into the cab. The problem with this 1988 Chevy V8 oil sender is that it is mounted near the rear exhaust runner and tends to fail because of the heat, and that might have been the root of the intermittent gauge anomaly. Donnie opted to fashion a heat shield with a piece of tin, which didn't hurt a doggone thing.

The 2001 Explorer

As the Mustang job was drawing to a close, the guys jerked the engine out of a 2001 Explorer that had the noisy timing chain syndrome for a partial rebuild. The guy wanted all the chains and nylons plus a total engine reseat, a new high volume oil pump and a fresh torque converter and seal, because they were exposed with the engine out anyway.

Matt set up the tools the way I had trained him so as to put the camshafts and crankshaft in time. For those who aren't familiar with this platform, it has three timing chains, one of which drives a jackshaft that spins in the bores where the old in-block camshaft rides on OHV engines. This jackshaft

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drives the two overhead cams via one chain on the left front and another on the right rear. There are no timing marks on anything, and you need the special tools to set the chains up. One tool locates the crank at No. 1 TDC, and there is a tool that puts each camshaft at the proper index before the cam gears are torqued, with the camshaft gear holder bolted to the head and pegged securely into the gear that is being torqued.



Read more on what to do and not to do when you're servicing today's A/C systems. MotorAge.com/acdents

That being said, if you understand how things line up, you might get these shafts pretty close. But the cam gear retainer bolts are all torque-to-yield and have to go another 90 degrees after initial torque, thus the need for special tools to lock things in place during that torque procedure. More engines than ever now are being built this way, and special tools abound. The timing chain job went on the back burner for lack of a couple of crucial parts that were en route, but the parts did arrive for the 2007 Edge A/C job.

Working on the Edge

The A/C wasn't cooling on this 2007 Edge, and while there were no blown fuses, the heavy scorch smell in the engine compartment pointed us to a partially shorted clutch coil that had lost its ability to magnetize but was producing enough heat to begin liquefying the rubber parts of the clutch pulley. A new compressor from Ford

runs nearly \$900, but you can get a new after-market unit for just less than \$500, and that option was pursued on this job.

Some A/C compressors can be replaced in literally 15 minutes, but this wasn't one of them.

Further, we all know it's a dereliction of duty to replace a compressor without also replacing the receiver/dryer, which in this case was one of those long white desiccant socks that goes in that skinny can built onto the side of the condenser. Because the compressor failure was external and there were no metal particles circulating with the refrigerant, the decision was made to leave the expansion valve alone.

I have yanked the plug and changed those desiccant socks quite easily on some other vehicles, but this Edge required quite a bit of work. The condenser has to be removed from the vehicle in order to access the plug on the bottom of the can that houses that desiccant cartridge, which is a moderately major operation that starts with coolant recovery. Donnie's Robinair J2788 compliant machine does a smashing job of that, and it also extracted three of the four ounces of refrigerant oil that were in the system.

Matt delved into ALLDATA, waded past some confusing pictures of bolts that didn't exist on this vehicle and figured out how to remove the fascia in short order.



This is the Snap-On borescope look up through the blower motor hole into the evaporator case. In addition to these leaves, there was a lot of dust clog.



This 2001 4.0L Explorer engine requires a lot of torque-to-yield work on the jackshaft and camshaft bolts and a bevy of special tools to keep everything locked in and in line.



I don't have a photo of the tool that locates the crankshaft at No. 1 TDC, but the tool at the top locates the camshafts and the tool at the bottom holds the gear securely during the torque-to-yield process. The bolt on the right rear gear is left hand thread, by the way.



This is a busy country shop all year around, is several miles outside the nearest town, but with a lot of regular customers who won't take their cars to anybody else.

Next, he drained that apple-juice-looking gold coolant, removed the air cleaner and unclamped the top radiator hose, bending it around and away from the work area. Then he set about to removing the fan, first disconnecting the shroud-mounted fan controller, then unclipping wire harnesses and whatnot that were attached to the shroud. Within a few minutes, the fan module was out and on the floor.

There were two more hoses connected to the radiator: one was the lower radiator hose and the other the one-inch coolant feed hose from the fill tank, which, on this platform, is mounted higher than the engine for easy bleeding. Donnie demonstrated his cabled spring hose clamp squeezer, much to Matt's amazement. (I don't have one of those in my department, but I should)

He and Donnie unclipped the radiator, disconnected the two plastic condenser line anchors from the passenger side radiator tank and tilted the radiator back so as to unbolt the peanut fittings from the condenser where each line was connected, and then they worked it out of there, bringing the condenser with it.



On the Edge, after recovering the refrigerant, the fascia had to be removed. The coolant the was drained and the fan and radiator/condenser package were removed so as to access the receiver/dryer sock. This is a TXV system, but there was no reason to change it for an external compressor failure.

“If you understand how things line up you might get these shafts pretty close. But the cam gear retainer bolts are all torque-to-yield and have to go another 90 degrees after initial torque, thus the need for special tools to lock things in place during that torque procedure.”

It was time to replace the desiccant bag by screwing the plug out of the bottom of the condenser with a 14 mm Allen bit, then he went to work fishing the old sock out of there with mechanical fingers. Sliding the new desiccant bag back in was easy, but the new plug



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Flipping the radiator and condenser upside down, it took a 14 mm Allen wrench to get this plastic filter plug out and some mechanical fingers to grab the sock. The new plug looked right, but wouldn't fit. Donnie used the new O-ring and the old plug. This kind of misfit happens a lot more than it should.

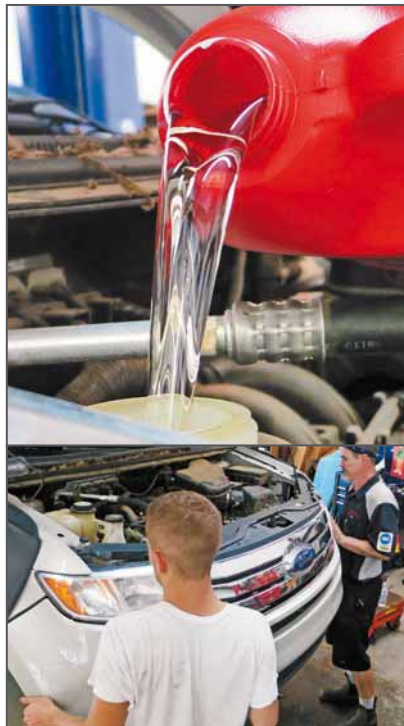


To remove the compressor, the bottom stud had to be screwed out of the mounting boss and removed with the compressor, which, in this case, showed signs of electrical coil failure. It didn't blow the fuse, but it got plenty hot enough to do this, and all the customer had was a blower moving hot air.



that came with it actually looked right but wouldn't fit. The flange on the bottom of it was too big install in the radiator. So Donnie filched the O-ring off the new one, installed it on the old one and had Matt screw the plug back in.

It made sense to replace the compressor while the radiator and fan were out of the way, and that job went like a song the lower of the three fasteners is. However, a nut and the stud that the nut mates to have to come out before the compressor can be removed. The hex on the end of that compressor retaining stud is a 5 mm, and Donnie worked it out of there with his battery cable pliers.



With everything reassembled (new O-rings) a 50/50 coolant mix poured in (no special bleeding necessary because the fill is higher than the engine on this one), a vacuum on the HVAC and the addition of 3 ounces of oil (the compressor had an ounce and a half in it) and a check for leaks, the fascia was reinstalled. The test drive was cool and comfortable, and service bay No. 4 was ready to take on another job.

The annoying thing about new compressors is that some of them come with paperwork in the box telling you how much oil is in the compressor and some don't. We took the plugs out of this one and turned the hub clockwise until we saw oil, then stood the compressor on its nose to lube the shaft seal. We ate the burritos and sweet tea Donnie's wife had brought us for lunch before stuffing everything back together, filling it with new Motorcraft Gold coolant, adding 3 ounces of fresh oil and 1.21 pounds of R134a. Reinstalling the fascia and the right front tire, a cool test ride down the road showed 46 degrees at the register with ambients in the low 90s.

With the fascia reinstalled, the Edge was customer-ready two hours before quitting time. It was a good day. **ZZ**



RICHARD MCCUISTIAN
CONTRIBUTING EDITOR

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

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STARTING/CHARGING MAINTENANCE IN WINTER MONTHS

As winter driving approaches, vehicle owners will be facing failures and repairs in the key category of starting/charging systems.

Starting/Charging: Batteries may be overworked more than ever on today's new vehicles due to competitive fuel economy ratings, so it is critical to keep this vital system in top-performing shape.

Battery terminals corrode over time, and the electrical resistance that builds up is enough to impede both the charging and starting systems. A small 0.1 ohm resistance at the battery terminals can reduce the starter's output by as much as 92 percent because of the enormous current needed. The power to the headlights may also reduce by up to 32 percent, which reduces their intensity by more than 50 percent.

So, why does this happen? Ohms law: When the current level is high, the voltage drop is proportionally high. For example, 0.1 ohm and 10A equals a 1V drop. Many charging and starting difficulties can be traced to corrosion or damage to terminals or wiring and loose connections. Spending a few minutes inspecting connectivity points and cable condition on your customer's vehicle can flag problems before they arise.

Heavy terminal corrosion can be neutralized and cleaned with a wire brush terminal cleaner and a solution of baking soda and water. If the corrosion is extensive, you may have to replace the cable or crimp and solder on a new terminal. When terminals are clean and dry, reattach the cables and coat the terminals with a special-purpose battery terminal insulation spray.

Next, check the starter terminals. Be sure the large terminal on the starter solenoid is clean and corrosion-free, the starter cable isn't damaged, and the connection to the starter is clean and corrosion-free. If current isn't flowing freely, you can't start and you can't charge.

The battery case itself should be clean, as voltage can leak from the positive terminal to the battery body and then the ground through dust and acid that collect on the battery case. Use a mild baking soda solution, and completely dry the battery before installing it.

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of the battery. ToughOne AGM batteries feature a reinforced plastic case, a unique venting system that maintains the seal, increased charge acceptance, and higher-density material on the positive grid to improve cycling. The batteries also use patented PowerFrame® grid technology, which eliminates premature failure and resists corrosion more effectively than other grid designs. This provides superior starting performance over the life of the battery, with up to 70 percent better electrical flow than other grid technologies.

AGM batteries are designed to easily fit today's vehicles, but they do have special installation and reset requirements when used in start-stop vehicle systems. Be sure to check the manufacturer's requirements, or call your local Advance delivery location to learn more about AGM battery offerings.

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COMMON FUEL SYSTEM DIAGNOSTIC MISTAKES

Here are some common diagnostic mistakes that can cost you time, money and frustration.

1. Replacing without Diagnosing - Assuming that the fuel pump is the cause of a no start situation is the wrong way to start a diagnosis. Just because your neighbor's car had a similar problem caused by a faulty fuel pump does not mean the same for you. There are thousands of components on a vehicle that must all work in unison for proper operation.

2. Not Enough Juice - Just because you can hear the fuel pump running does not mean the pump is receiving proper voltage. Low voltage or poor ground can cause low pressure and flow. If the pressure is low at the rail, be sure to check the voltage at the pump to make sure it is within a 0.5 volt of the battery. Also make sure the battery is fully charged as this will affect the fuel pump as well as all other systems.

3. Jumping to conclusions - Many installers replace the fuel pump based on their assumptions of a particular fuel system.

Make sure that you understand the fuel system before diagnosis, as there are many configurations requiring different methods. Low maximum pressure on a PWM (Pulse Width Modulated) system does not necessarily mean the fuel pump is at fault. The PCM sends the fuel

pump driver module a signal. The driver module using this information turns the pump on/off many times to create the correct pressure. A faulty driver module/incorrect information being sent to the PCM can affect the fuel pressure without a bad fuel pump being the cause.

4. Over & Over - If you replace any part on a vehicle and keep having repeated failures, more than likely there is

something else wrong in the system. A fuel pump will only deliver the pressure and flow that is asked of it. Low voltage, fuel regulator issues, driver module problems, etc. cannot be repaired by replacing the fuel pump. Make sure to perform thorough diagnostics before replacement.

5. Same Problem, Different Day - You replaced the fuel pump, but still have the same problem. At this point you need to start the diagnostic process over. If after replacing a part you have the same symptoms then the real issue has not been solved. It is highly unlikely that your original pump and replacement pump would both fail.

6. Running on Empty - The fuel gauge on your dash is always on empty. Must be a bad sender right? Not necessarily. The sending unit is only one part of the system. A poor ground, faulty signal wire, inoperative dash gauge or a bad buffer could be the cause. Any of these parts can have the same effect on the system as an inoperative gauge. Make sure to diagnose this system the same as any other system...from the beginning.

7. Grounds, Grounds, Grounds - An electrical circuit must have a signal (power) and a return (ground) wire to work. You may have good voltage at the pump but don't overlook the ground. A corroded or broken ground connection cannot complete the circuit. The pump will either not work or work inefficiently. Installing a new fuel pump into a system with a poor ground still won't fix the issue.

8. Out of Gas - Most importantly, an automobile needs fuel. Make sure to check if you have gas in the tank. You can waste a lot of time diagnosing a no start condition when the only problem was that it was out of gas.

9. Using the right tool for the Job - Using the wrong tool can provide incorrect information that will lead to a misdiagnosis. Make sure when checking fuel pressure to use a fuel pressure gauge. When checking the electrical circuits use a DVOM (Digital Volt Ohm Meter) versus a test light as it can only tell you if you have voltage, not how much voltage.



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ANSWERING CUSTOMERS' WHEEL-RELATED QUESTIONS

Real answers for when your customer asks, "Why are my wheels so dusty?"

And "Why is my brake pedal pulsating?"

These facts may surprise you.

First, dust.

Wheels tend to accumulate brake dust under normal use — some more than others. The difference can usually be attributed to what type of brake friction is being used — abrasive or adherent. So, what are the differences between abrasive and adherent friction material?

Abrasive Friction

Abrasive friction is the mechanism where abrasive particles in the pad are - in a crystalline sense - harder than the materials in the rotor. What this means is that as the abrasive pad contacts the rotor face under braking, a small but steady amount of rotor material is shed. Under normal use, therefore, abrasive friction tends to produce more dust, primarily due to rotor wear. This is the friction mechanism that best describes the function of Low-Metallic formulas found more often in European vehicles as well as some Asian and American high performance applications.

Adherent Friction

Adherent friction is another type of friction mechanism, where the transfer of a thin layer of brake pad material transfers onto, and adheres to, the rotor face. Proper bedding-in helps create an even transfer layer of pad material on the rotor. Uneven pad material transfer or pad material deposits will cause brake judder, which is often misidentified as "warped rotors". This results in less wear to the rotor, and therefore less dusting. Most Semi-Metallic (semi-met), Ceramic and non-asbestos organic (NAO) formulas fit into this category, which is most often seen on mainstream North American and Japanese vehicles.



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TEN MAF SENSOR INSTALLATION TIPS

Mass Air Flow (MAF) technology is highly specialized. These sensors use tiny, sensitive components to carefully measure the volume (and sometimes temperature) of air flowing into the intake manifold. This information is delivered to the ECM to calculate fuel delivery.

MAF Sensor analysis has shown that many failures are the result of an external problem. Before installing a new unit, make every effort to determine why the original unit failed. Shorted wiring, failed connections or contaminated air flow must be corrected, and the engine must be properly tuned. If all necessary repairs are not applied, the replacement unit could fail or not perform as expected. However, applying the tips below in addition to following the vehicle's service manual should help make sure each MAF sensor installation is a success.

1. Check for trouble codes. The vehicle may have problems that prevent the sensor from proper operation. Repair or correct these as required.

2. Inspect the wiring and connectors.

This can be easily overlooked, but a faulty or damaged wire or connector could cause annoying, intermittent problems.

3. Verify reference voltage and grounds.

Typically the ECM supplies a regulated reference voltage to the sensor. If not present, check the ECM operation. In addition to performing ground continuity checks, it's recommended to perform voltage drop tests on all grounds.

4. Be sure to eliminate any vacuum leaks downstream of the MAF sensor.

If not corrected, this will introduce unmeasured air into the system, resulting in a drivability issue and most likely an illuminated check engine light. Inspect the air inlet duct and connections. Also check for loose clamps, duct cracks or other damage.

5. Check airways for contamination/obstruction.

A dirty MAF sensor will not respond as quickly to air flow changes as a clean sensor. It's recommended to replace the air filter with an O.E. approved unit when you replace the MAF sensor. Note: Some poor quality paper filters shed material and can coat the sensor element with fibers restricting performance.

6. Check for oil-impregnated air filters.

If excessive oil is applied or if the filter is improperly serviced, it is possible for oil residue to build up on the MAF sensor element and hinder operation.

7. Inspect the electrical connector weather seal condition. If a weather seal is used on the



electrical connector, be sure it is transferred to the replacement unit. Inspect for damage and install on the connector properly to ensure water intrusion protection.

8. Prevent static discharge and voltage surges.

Protect the replacement unit from static electricity discharge. Be sure to disconnect the battery ground cable before unplugging the MAF sensor. NOTE: Provide keep-alive power to avoid loss of adaptive strategies and settings in other modules.

9. Check for proper operation using a diagnostic scanner (if applicable). Verify sensor data and check for vehicle trouble codes.

10. Always follow the vehicle's service manual for specific diagnostics and complete installation instructions. Be sure to use proper tools, techniques and safety procedures when servicing the vehicle.

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Whether it's a complete sensor replacement or just a sensor service, these videos will show you the proper procedures for ensuring that both the sensor and the entire TPMS system are functioning properly, and can continue to deliver the safety protection intended by the manufacturer and expected by the vehicle owner.



These helpful videos will show you how to do the job right the first and every time, avoid troublesome short cuts and eliminate profit robbing comebacks and customer complaints. The entire series has received the Car Care Council's recognition for "Best 2013 Training Materials."

VDO REDI-SENSOR TPMS TRAINING SERIES:

No. 1: Vehicle Relearn vs. Sensor Programming – Explains the differences between a traditional TPMS vehicle relearn procedure and the new sensor programming procedure required by some 'universal' and 'programmable' TPMS sensors.

No. 2: Valve Stem Replacement – Shows proper valve stem removal and replacement procedure for TPMS sensors, featuring the VDO REDI-Sensor Multi-Application Sensor.

No. 3: OBDII Relearn – Guides through the TPMS installation and OBDII relearn procedure for many Asian brands

such as Nissan, Toyota, Lexus, Scion, Honda and Hyundai vehicles. Vehicle: 2010 Honda Accord.

No. 4: Magnet Trigger Sensor Relearn – Installation and relearn procedure for vehicles with OEM magnet trigger sensors, including Ford, Chrysler, Mitsubishi and some GM and Isuzu models. Vehicle: 2005 Ford Expedition.

No. 5: GM Key Fob Relearn – Installation and guide through the Key Fob TPMS relearn procedure for many GM vehicles. Vehicle: 2008 Chevrolet Malibu.

No. 6: Ford Push Start Relearn – Installation and relearn process for Ford vehicles with a push button start. Vehicle: 2013 Ford Flex.

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No. 8: Chrysler OBDII Relearn – Installation and OBDII relearn procedure for many Chrysler, Mazda and European vehicles that are otherwise auto-learn by driving. Vehicle: 2008 Dodge Caliber.



VDO REDI-Sensor is a multi-application TPMS sensor that covers over 85 percent of all vehicles in North America with only three sensor SKUs and replaces over 140 OE sensors. REDI-Sensor is designed to follow standard OE vehicle relearn procedures and works with all major TPMS scan tools, including those from ATEQ, Bartec, OTC / SPX, K-Tool (T.I.P.S.) and Snap-on.

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Even regular customers will throw you a curve ball now and then. Recently, a long-term customer brought a 2007 Chrysler sedan in for service. Unexpectedly, they had a 1998 Honda Accord towed in at the same time. Sitting static for just over two years, it needed all fluids changed, a battery, front brakes and an AC compressor, yet seemed in good enough shape for the customer's teenage driver. They asked me to make it safe and reliable. After calling my local Chrysler dealer for Mopar® parts, my counter person asked what else I was working on. I told him about the Honda, lamenting the lost time I'd spend chasing parts for that one.

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That's when he told me about Magneti Marelli Offered by Mopar parts. It turns out that my reliable Mopar dealer now offers a very complete line of service, maintenance and replacement parts for all makes and models. The upshot is that I could order everything I need for the 2007 Chrysler and the 1998 Honda Accord in the same phone call and in the same order. Everything was here for both cars in 35 minutes.

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I was able to get high-quality front brake pads with an installation kit, a battery and an AC compressor for the Honda. All of the Magneti Marelli components fit perfectly and in no time the old Honda was running perfectly, stopping true, with air conditioning blowing frosty cold.



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When I added up the order, I was surprised that the Magneti Marelli total for Honda items was cheaper from my Mopar dealer than from my local imported car parts distributor. I can't even imagine what the tab would have been at the Honda dealer. My customer is happy and satisfied with a freshly serviced sedan and a newly rejuvenated older import, while I'm delighted with the hassle-free time-savings of one-stop shopping to get competitively priced parts for a 2007 Chrysler and a 1998 Honda in the same phone call and on the same order.

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AN OXYGEN SENSOR OVERVIEW

In the 1970s, EPA regulations were designed to reduce air pollution. They were the catalyst for the development of engine control systems, which helped reduce exhaust gas emissions, improve fuel economy and optimize engine performance. These new engine control systems became possible with the development of the first oxygen sensor introduced in 1979. This early sensor type had either one or two wires and because it is not self-heated, could take several minutes to reach its operating temperature of 600° F. Stringent emissions requirements led to the invention of a more efficient type of sensor, the “heated oxygen sensor”. These three, four, and five wire sensors are heated by a separate circuit and can reach proper operating temperatures in 30 to 60 seconds.



The oxygen sensor is made with a zirconia (zirconium dioxide) element and platinum electrodes, and generates a voltage signal based on the amount of oxygen in the exhaust compared to the atmospheric oxygen. With one electrode located within the exhaust flow and the other electrode exposed to the atmosphere, the sensor reports the exhaust oxygen level, to the vehicle’s Engine Control Unit (ECU), when operating temperature is reached (600° F). The ECU can determine if the air/fuel is rich or lean and adjusts the fuel mixture accordingly. A rich mixture consumes nearly all the oxygen, so the voltage signal is high, in the range of 0.6 – 1.0 volts. A lean mixture has more available oxygen after combustion than a rich mixture, so the voltage signal is low, 0.4 – 0.1 volts. At the stoichiometric air/fuel ratio (14.7:1), oxygen sensor voltage output is approximately 0.45 volts.

Air/Fuel Sensor Offers More Accurate Readings

In 1997, DENSO introduced its patented air/fuel sensor to the market. This new A/F sensor utilizes an advanced detec-

tion circuit and gold plated terminals for excellent signal strength and conductivity when operating at 1,200° F. This allows the ECU to more accurately calculate the exact air/fuel ratio.

Symptoms of a Failed Oxygen Sensor

Many drivers don’t even know their vehicles have a bad oxygen sensor until they fail a smog test or a vehicle check engine light illuminates. Often, when an oxygen sensor is not functioning efficiently, it will leave signs that it needs replacing. If your customer is experiencing poor gas mileage or poor engine performance, they may have a faulty oxygen sensor. It’s always a good idea to check the oxygen sensor during tune-ups or other maintenance service to be sure it’s operating efficiently.

Oxygen Sensor Installation Tips

When removing or replacing an oxygen sensor, it’s important to use the correct tools. Special deep-well O₂ sockets are recommended to prevent damage to the harness and connector. Before installation, be sure anti-seize has been applied to the threads. (Disregard for flange type sensor.) A new oxygen sensor should be installed by hand, making sure it is not cross-threaded, and then torqued to manufacturers specifications. (For flange type sensor, use new gasket included with sensor.)

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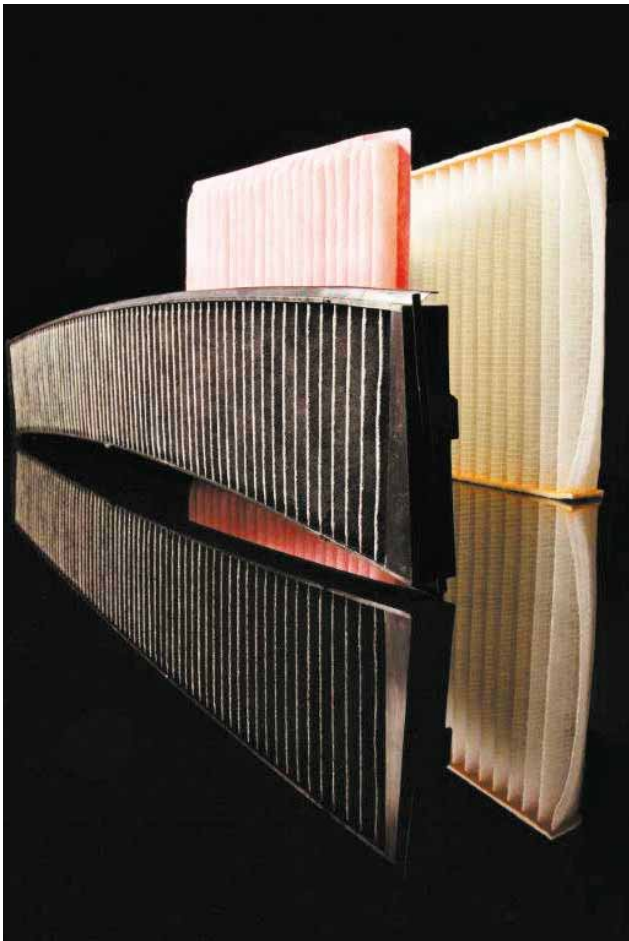
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AN OVERVIEW OF CABIN AIR FILTER

With increasing public concern about air quality and traffic related contaminants cabin air filters have become a more important necessity. First implemented in northern Europe in the late eighties, the products were particle filters that protected passengers from pollen and dust. The concerns soon expanded to include odors and other particles like diesel soot or gaseous substances like sulphur dioxide, nitrous oxides, or hydrogen sulphide. The industry soon reacted with adsorptive filter systems using activated carbon as the removal mechanism in many grades and to achieve performance characteristics.



Almost all vehicles sold in the North America today have a cabin air filter of some sort, however many owners are not aware that they even have one. If they are aware, they were not clearly informed as to why it should be changed, therefore it generally was not replaced. This can lead to filtration blockage, decrease in electrostatic efficiency, reduced odor removal, and it can become a source for breeding bacteria and other allergens, just to name a few.

Another concern could be additional stress put on the HVAC system due to airflow restriction. So the next time you are having problems with a vehicle air conditioner not cooling, be sure to consider if the cabin air filter needs to be replaced.

Depending on the driving conditions, most vehicle manufactures recommend replacement of a "Pollen cabin air filter" every two years, and changing a "Carbon cabin air filter" every year. Using the vehicle owner's manual would be one of the best ways to determine the cabin air filter type for the vehicle. If the vehicle owner's manual calls for a Pollen type filter and you chose to upgrade, when available, it would be advisable to note the change in the owner's manual.

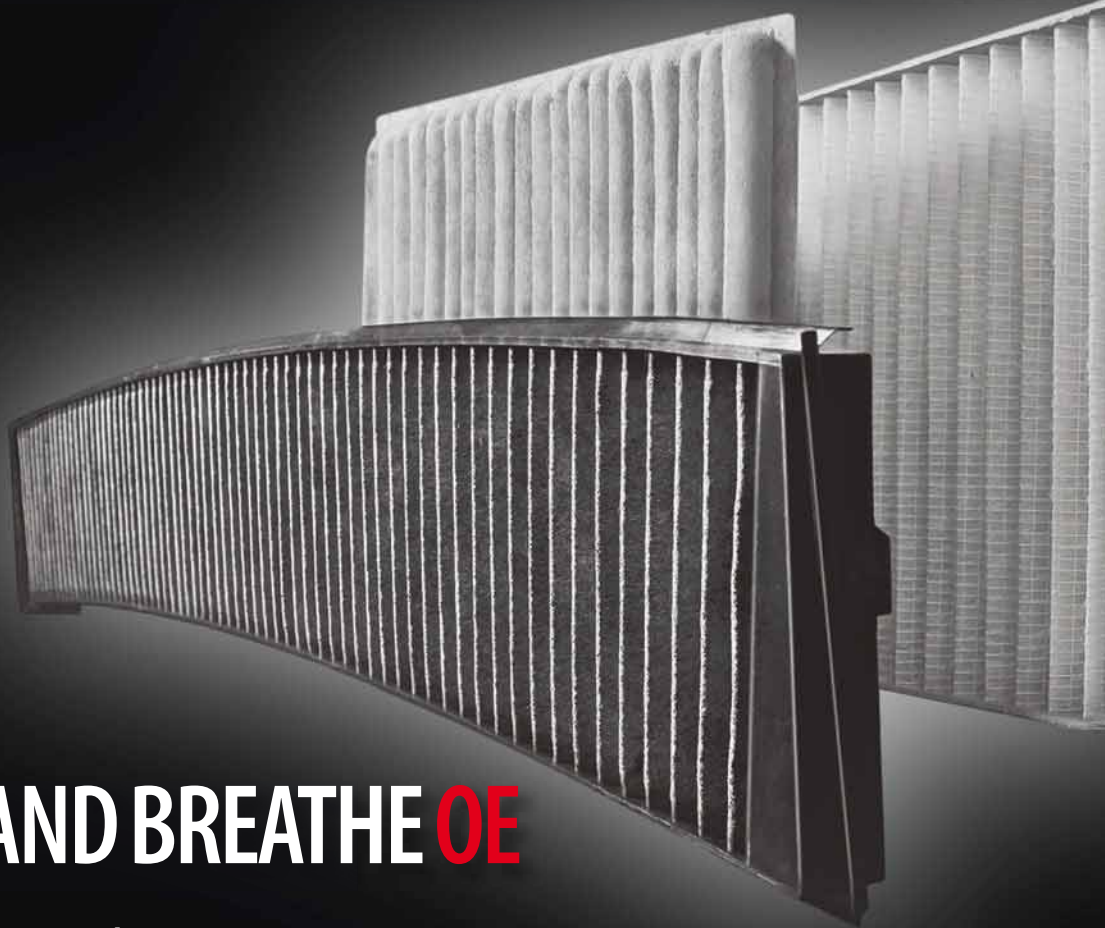
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HOW DO YOU IDENTIFY A CARB-COMPLIANT CONVERTER?

By **Charlie Pantano**, Eastern Catalytic

Now that New York and Maine have enacted the same aftermarket catalytic converter legislation as the state of California, other states are expected to follow. As a result, knowing which catalytic converter to install in the customer's vehicle and making sure the one you picked is legal and fits properly can be a tricky affair. You can't always tell just by looking at the VIN or year, make and model of the vehicle. The best way to do the job right and stay within the letter of the law is to know what to look for.

CARB converter labeling

According to CARB requirements, every new CARB-compliant replacement converter must display a certification stamp or label on the converter shell that includes the CARB Executive Order approval number, the part number, date of manufacture, and proper installation direction. This is the only way you can be sure that you are installing the CARB-compliant converter on a vehicle that requires it.



CARB vs. Federal – how do you know?

Before you service a converter, you must determine whether the vehicle was manufactured to CARB or Federal specifications. Check the vehicle's emissions system label, which can be found on the front radiator support, the strut tower plate, or under the engine hood. If the vehicle is California Emissions Certified, the label will reference "California," "CARB," or "ARB."

Next, you must determine the "Engine Family Number", which can also be called the "Engine Family Code," "Test Group," or "Group Number." The number can be found on the Emissions Control Information Label. It is vital to know this number when selecting a replacement converter. If the

label is missing, contact the OE dealer to get the "Engine Family Number."

For more information about NY Emissions Standards, contact the New York State Department of Environmental Conservation Division of Air Resources / Bureau of Mobile Sources at: (518) 402-8292.



Typical Emission Labels

VEHICLE EMISSION CONTROL INFORMATION			CARB System Label
A motor co, inc.	ENGINE FAMILY DISPLACEMENT EFN2.8YBT2BA 2.8L	OBD II CERTIFIED	
THIS VEHICLE CONFORMS TO U.S. EPA AND STATE OF CALIFORNIA REGULATIONS APPLICABLE TO 1997 MODEL YEAR NEW TLEV PASSENGER CARS.			FEDERAL SYSTEM LABEL
REFER TO SERVICE MANUAL FOR ADDITIONAL INFORMATION TUNE-UP CONDITIONS: NORMAL OPERATING ENGINE TEMPERATURE, ACCESSORIES OFF, COOLING FAN OFF, TRANSMISSION IN NEUTRAL.			
EXHAUST EMISSIONS STANDARDS CERTIFICATION IN-USE	STANDARD CATEGORY TLEV TLEV INTERMEDIATE	EFN2.8YBT2BA	GVWR 2268 KG (05000 LB) RIMS AT 14 X 5.5 COLD 380 KPA(35 PSI) RIMS AT 14 X 5.5 COLD 380 KPA(35 PSI)
SPARK PLUG TYPE NGK BPRE-11 GAP: 1.1mm	CATALYST	1225 KG (2700 LB) WITH TIRES P195/75R14	
THIS VEHICLE CONFORMS TO ALL APPLICABLE FEDERAL MOTOR VEHICLE SAFETY STANDARDS IN EFFECT ON THE DATE OF MANUFACTURE SHOWN ABOVE.			VIN: XXXXXXXXXXXXXXXX TYPE: SINGLE X DUAL MDH: 010615 021 PAINT:POP VEHICLE MADE IN USA TRIM:05C3 484805
VIN: XXXXXXXXXXXXXXXX TYPE: SINGLE X DUAL MDH: 010615 021 PAINT:POP VEHICLE MADE IN USA TRIM:05C3 484805			

Informative videos and technical tips on emissions identification and other catalytic converter service topics can be found in the Education section of the Eastern Catalytic website at www.easterncatalytic.com.

Charles Pantano is the Certification Program Manager at Eastern Catalytic, a leading innovator and world-class manufacturer of catalytic converters. Eastern offers a full range of catalytic converters for universal, direct-fit, manifold, diesel, and heavy-duty applications.

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WHY AGM BATTERIES NOW?

Changing forces in the aftermarket battery industry today have created new demand and sales opportunities for AGM products. AGM's innovation and technology is a response to market demands and customer needs for changes in automobiles. Exide's AGM batteries form one of the most complete lines in the industry and provide customers with the ability to serve today's active families and busy professionals, from minivans to SUV's and trucks to boats and RVs.

Until now, demand for aftermarket AGM batteries has been relatively small - focusing on niche segments such as off-road and car enthusiasts. New regulation and fuel cost are driving changes and improvements in vehicle technology that continue to place additional demands on the car's electrical system. In addition, today's consumers are holding onto their vehicles longer, resulting in increased opportunities for maintenance. OEMs are responding to growing economic trends and government regulations by utilizing AGM battery technology. Because of all of the benefits that AGM has to offer, OEMs are using it in many hybrid and non-hybrid applications. OEM/OES will be a major driver of AGM adoption over the coming years. Customers will need to be educated and prepared to service vehicles with advanced technologies.

Advanced technologies place more demands on electrical systems in today's vehicles. Current systems are being pushed to their maximum capacity and OEM specifications don't always account for the aftermarket additions made by the end user. The failure rate of worn-out batteries increased 42 percent from 2005 to 2010¹. These demands are driving much needed improvements for better performing batteries.

Most consumers are not aware of AGM technology. However, AGM technology is attractive to mainstream consumers once benefits are explained. Research shows that +80 percent are "interested or very interested" and nearly 1/2 are "likely to purchase"². It will be critical to quickly and simply communicate awareness and benefits of AGM to consumers through counterperson training and selling materials. When given a choice over flooded batteries, consumers are significantly more interested in AGM.

The Exide[®] Edge™ AGM batteries are the first and only* products that feature SureLife[®] Graphite Technology to maximize available energy capacity— helping batteries to perform at higher levels longer. Edge provides 17X more energy for everything, like repeated use of technology and shuttle driving³, as well as up to 15 percent more starting power⁴. At 2X longer life versus conventional flooded batteries, Edge provides more protection against battery failure, helping vehicles stay strong and perform like new.



Exide Edge batteries are ideal for everyday consumers. With 56 percent VIO (vehicles in operation) coverage, they are targeted to meet mainstream consumer vehicle requirements. Exide Edge provides more protection against battery failure, helping the vehicle's battery deliver a new level of performance and protection. Charge acceptance and longer life are the best benefits of the AGM battery; the Edge technology benefits today's mainstream vehicles and tomorrow's hybrid vehicles.

1 Source: 2010 Battery Council International Report

2 Source: Exide Technologies AGM Batteries Research Phase Quantitative Summary, December 2010

3Based on average results of five batteries tested per the VDA 17.5 percent DOD; results are versus conventional flooded batteries. The test measured the number of times the tested battery turned over its capacity before failure when taken down to 17.5 percent depth of discharge. This is not life duration test, and does not mean the battery will last 17 times longer.

4 Ford Explorer -18 degrees Celsius / Group 65. 15 percent is the maximum average result for six Group 65 batteries tested at 90 percent state of charge in a Simulated Start Test. Results are versus conventional flooded batteries. Actual increases in starting power will vary, and will be less for some other Group Size batteries, and at different states of charge for Group 65 batteries.

All claims made versus conventional flooded batteries.

* Among leading competitors





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Confidence, Performance & Protection for Today's Drivers

Driving habits have changed and AGM batteries are becoming the battery of first replacement. Today's drivers have more electrical devices to charge, advanced technology to power, and more key-on/key-off moments during the day. Exide® Edge™ AGM batteries are the first and only with SureLife® Graphite Technology.* They are designed to meet the demands of today's busy drivers - from start to destination, and every point in between.

*Among leading competitors



Made in the USA with some foreign components



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LET FEDERATED AND KYB HELP YOU BECOME THE ESC EXPERT

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

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

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

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

A vehicle's ESC system has an array of sensors providing vehicle operation conditions to one of the vehicle's on-board



Our Precision, Your Advantage

computers. When the computer determines that the vehicle is losing control, it instantly begins reducing engine speed through the engine management system and then applies the appropriate individual brake in just the right proportions to keep the vehicle in control.

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

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

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

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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.

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

SUPPLEMENTAL RESTRAINT SYSTEM (SRS) – INTERMITTENT FAULTS

Supplemental Restraint System (SRS) intermittent warning lights and faults can frustrate even the most competent service technician.

These systems come in a wide variety of configurations, from the front driver and passenger single-stage airbag-only system to dual-stage advanced rollover safety systems that include airbags in the headliner and even in the safety belts.

A system that extends to so many different locations with so many components requires a large number of electrical circuits and connectors. And any fault in a connector or circuit that changes its resistance can illuminate the airbag warning light. Diagnosis and service of an SRS can be pretty straightforward when a hard fault occurs due to a failed component, such as an airbag module. However, intermittent faults with their accompanying on-again/off-again airbag warning lights can be difficult to correct.

A lesser-known cause of high resistance and intermittent connections can be the result of a condition called “terminal fretting.”

Fretting is a condition discovered by electrical engineers that can affect low-voltage circuits, such as those of the SRS. Fretting is caused by micro-arcing between the male and female terminals of a connector. The concern may go away by disconnecting and reconnecting the connector, but may reappear later. There is no test for this concern, and you may not be able to see the fretting on the terminal itself.

When an electrical connector is first connected, a thin oxide layer cracks under pressure when the contact is first made. Clean metal is exposed through the cracks in the oxide layer, making a very stable electrical connection. If the contact spot moves a microscopic amount, from the fretting motion, which is basically wiggling of the male pin inside the female connector, the clean area is exposed to the air and can quickly form an

insulating oxide film. Every time there is motion at the contact spot, the cycle repeats and more oxide debris builds up. With continued microscopic fretting between contacting surfaces, enough insulating oxide wear debris can build up, producing high resistance and/or intermittent connections.

Severe cases of fretting corrosion look like little dark smudges on electrical terminals. The smudges appear at the locations where the actual electrical contact is made.

One step that can be taken to help prevent fretting is to make sure the connectors fit tightly together, and that movement and shaking around them does not allow them to wiggle. For example, make sure that the power-seat wiring does not bind when the seat moves along its track.

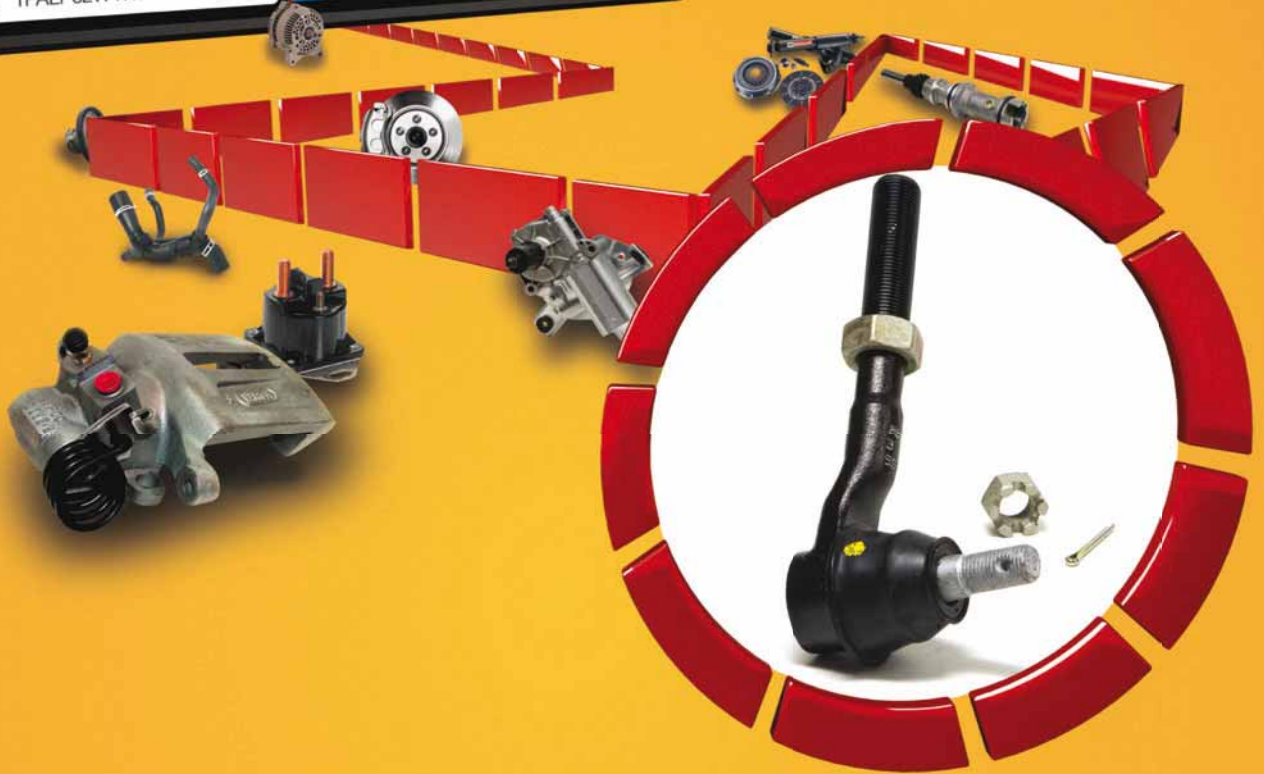
As you may expect, these parts are specific to vehicle year and model and are usually only available from the manufacturer. If you need SRS wiring harnesses, airbag modules or impact sensors for a Ford, Lincoln or Mercury, many can be found and ordered at FordParts.com.

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SERVICE MARKET TRENDING TOWARD PREMIUM SEALING TECHNOLOGIES

Tens of thousands of vehicles are plagued with chronic leaks ranging from nuisance driveway stains and the need to periodically replenish leaking fluids to those that can cause drivability problems, decreased fuel economy and even physical and catastrophic engine damage. Leak repair is inherently problematic and requires a wide variety of application-specific sealing materials. Most important, there are major differences in the materials and designs of gaskets now available for these types of repairs.

Molded rubber has fast become one of the most popular gasket and seal materials. But the term “molded rubber” actually refers to a broad portfolio of specialized formulations, each having a well-defined range of capabilities. Some molded rubber materials are appropriate for use in seals or gaskets that come in contact with fuel. Others might quickly break down when exposed to fuel, coolant and other chemicals. Other materials are resistant to extreme temperatures, some aren't. Variations in product material and design could lead to a potentially expensive comeback.

Tech Tip: Molded Rubber Chemistry Solutions

A material's chemical properties are invisible, so you are placing your trust in the manufacturer to develop and apply the right chemistry to the thermal, chemical and other demands the gasket or seal will face. As a world leader in molded rubber technology, Federal-Mogul manufactures Fel-Pro® gaskets and seals from nitrile, polyacrylate, VITON®, silicone, PTFE rubber and a variety of other advanced materials, and provides first-to-market solutions for tough sealing challenges.

While most standard gaskets from any brand will provide an initial seal, some won't stand up to chemicals, vibration and the harsh operating environment of the engine. When you choose Fel-Pro, you have the confidence that you're getting precisely the right material and the right design and construction for that specific repair.

Federal-Mogul developed premium Fel-Pro PermaDryPlus® gaskets specifically for troublesome sealing situations. In-house proprietary molded-rubber chemistry and formulations were developed to stand up to all types of coolants and oils with a proven ability to resist the destructive forces of thermal expansion/contraction, vibration and electrolysis.

These premium gaskets feature specialized technologies that solve sealing problems commonly encountered in the repair environment. Unaffected by harsh environments and impervious to all types of coolant and oils, the leak sealing technology of Fel-Pro PermaDryPlus gaskets provides a permanent seal and is absolutely the right replacement choice.



Sweltering summer heat has already set up many gaskets to fail, causing their plastic carriers to lose rigidity and become deformed, creating leak paths. Dropping temperatures in the fall will cause them to become brittle and break. Therefore, peak repair season for intake manifold gaskets is right now.

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LOW-COPPER BRAKE LEGISLATION CHANGING YOUR BUSINESS



If you follow the automotive business media, you know that low-copper brake pads are quickly becoming the new standard within the North American market. The move to advanced low-copper ceramic formulations is being driven by leading original equipment vehicle manufacturers in response to recent legislation in California and Washington state calling for the phase-out of copper and other potentially hazardous materials from ceramic brake pads.

As the number one global manufacturer of friction for the total OE and replacement market, Wagner® Brake has developed the first full-line offering of 2021-compliant low-copper formulations. Now available in Wagner ThermoQuiet® Ceramic^{NXT} brake pads, these highly advanced, proprietary formulations meet legislative requirements while providing significant, across-the-board improvements in overall brake pad performance.

The following questions and answers will help you understand how the rapid shift to low-copper ceramic brake pads will benefit your business.

Why is copper content being regulated and what role does it play in conventional brake pads?

Copper has traditionally been a friction modifier used in conventional ceramic formulations, often representing up to 20 percent of material content by weight. To help protect aquatic organisms, California and Washington state recently passed legislation requiring that copper and several other materials be phased out of OE and replacement brake pads. Copper content must be reduced to less than 5 percent of material content (“low copper”) by 2021 and less than 0.5 percent (“zero copper”) by 2025. Wagner Brake has already met the 2021 requirement with the introduction of Wagner OE21™ low-copper formulations.

How does this affect my shop?

Leading OE vehicle manufacturers are already shifting to low- and zero-copper formulations in millions of vehicles to be sold in all states beginning with the 2014 model year. As a result, low-copper technology will be coming to your market on several of the latest and most popular vehicle models. In addition, the dramatic benefits of Wagner ThermoQuiet Ceramic^{NXT} pads featuring the new 2021-compliant formula-

tions can help you provide significantly better brake performance for virtually all customers, beginning today.

How were Federal-Mogul and Wagner Brake engineers able to meet the 2021 requirements so quickly?

Federal-Mogul’s global R&D teams developed a unique process called tribological “fingerprinting” that enabled them to isolate and map the behavior of copper within the friction material over a full range of operating conditions. Once they fully understood how copper reacts during brake operation, they were able to substitute and compare the behavior of some 1,500 alternatives. Each Wagner OE21 formulation represents a unique matrix of several of these new materials as needed to meet the braking requirements of the corresponding application.

How do the new Wagner ThermoQuiet Ceramic^{NXT} brake pads compare with other pads in terms of overall performance?

The new, 2021-compliant Wagner ThermoQuiet Ceramic^{NXT} pads are 35 percent quieter and offer 15 percent more stopping power and up to 40 percent greater fade resistance than previous ThermoQuiet ceramic formulations. In short, these are the best Wagner ThermoQuiet pads ever.

How can I know whether a set of brake pads features 2021-compliant low-copper formulations?

The Automotive Aftermarket Suppliers Association (AASA) and industry brake manufacturing registrar NSF International have established a series of “LeafMark” designations to be used on product packaging. Wagner ThermoQuiet Ceramic^{NXT} brake pads featuring the new, OE21 formulations will carry the Level “B” 2021 LeafMark packaging logo, which designates full compliance with the low-copper requirement.

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A Stop Ahead.™

YOU HAVE A LOT RIDING ON GABRIEL READYMOUNT FULLY LOADED STRUTS – SO DO WE

A strut module assembly is a structural sub-system in the suspension/steering system of the vehicle. As such, it requires the highest level of quality and performance to ensure vehicle safety and control. So it's important that you know that the fully loaded struts you put on your customers' vehicles have been carefully designed and extensively tested to live up to real-world demands.

"Gabriel recognizes the design and testing that needs to go into all the components and the unit to ensure it meets the vehicle requirements, specifications and durability," said Michael Lipski, vice president sales and marketing, Gabriel®.

That's why Gabriel engineers, located in the Detroit area, precision engineer each new ReadyMount® application to strict tolerances based on their unique knowledge and clear understanding of the original equipment part, the vehicle design, and the performance requirements of the assembly. Only components that meet Gabriel's high standards are specified and used in the assembly.

Gabriel starts with a MacPherson strut or coil-over shock design that has been validated to 1,000,000 cycles with a super-finished chromed piston rod for superior corrosion resistance. A structural rigidity test is conducted on the strut to ensure that it meets Gabriel requirements for cornering and braking. Gabriel then adds a premium strut mount, bearing, jounce bumper, dust boot, coil spring, and spring isolator(s).

But that's only the beginning...

Gabriel extensively tests each new ReadyMount design and its individual components on a quarter car testing rig to simulate the real-world articulation of the assembly:

- The assembly is tested to full travel to make sure it lives up to the extreme demands of North American roads and weather
- Side load compensation is also tested to ensure that friction on the strut is minimized
- Steering is simulated to ensure durability of the bearings
- Coil springs, which are a key component to the desired ride, are tested for performance and durability
- A durometer test checks the rubber isolators' load resistance and durability
- Limit load tests, on the rebound springs (or rebound bumper) and on the jounce bumper, are conducted to extreme loads to simulate deep potholes and high curb strikes

Once all quarter car rig testing is assessed, engineers do a complete teardown analysis of the design and all of the components are examined to certify there is no excessive wear.

"We do all this to ensure the components in the final assembly are integrated for fit, form and function, to work as a complete suspension system," said Joseph Davis, director of engineering, Gabriel.

Then Gabriel takes it a step further by Fit-testing each new ReadyMount design on the very vehicle application for which it was designed, verifying first-hand that the design fits properly and can be easily installed. Finally, Gabriel technicians

Ride-test the ReadyMount design on U.S. roads to make sure it meets real world performance and Gabriel's standards.

If there is a question, the same Gabriel technicians who Fit- and Ride-test the ReadyMount applications are the Answermen that installers and customers speak to when they call the Gabriel Tech Line.

Not all manufacturers Fit- and Ride-test their module assemblies, and not all manufacturers engineer and design their products to the tight tolerances and precision specifications that Gabriel does for its ReadyMount fully assembled struts. But it's the right thing to do and the right way to do it. Gabriel has a lot of history riding on our products and we think it's what you should expect, especially from the company that designed the first automotive shock absorber in 1907.

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



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TOOL STORAGE SOLUTIONS FOR THE PROFESSIONAL MECHANIC

“You can perform any job when given the right tools.”

One of the biggest issues shops face is misplaced tools. Few things can sap productivity and customer satisfaction quicker. Organization is a key factor in keeping garages operating efficiently. Without it, you risk business failure.

An upgrade to toolboxes was the obvious answer to this problem. Most top line shops have (literally) invested in huge, centralized storage units that pull double-duty as workstations. Although they are an excellent addition to any garage, most professional mechanics will agree on one major drawback: They're stationary.



Fifty years ago, it may have been fine to have a centralized tool station; it was a time when shops were smaller and there were a lot less cars out on the road. Indeed, things have changed. So how does a professional mechanic in today's fast-paced shop environment keep his tools within reach? Well, the guys over at Homak have come up with an answer.

You Asked. We Listened. Homak Manufacturing is proud to introduce the all-new, 56-inch Stainless Steel Top Rolling Cabinet. This product is a major upgrade from the run-of-the-mill mobile storage units churned out by other companies; offering high quality and value at price points that won't bust your budget.

If you're in need of a professional, mobile workstation, then look no further than our 56-inch Stainless Steel Top Rolling Cabinet. It's basically a fortress on casters: Four 5x2-inch heavy duties, to be exact. Featuring 5 drawers equipped with full-length, contoured aluminum pulls and removable, 450mm ball-bearing slides; you'll always have enough space to store your precious equipment. Just in case you wanted more, we've added two huge locking compartments – each with a pull out drawer and height-adjustable shelf. The stainless steel wrapped top is more than just for looks (Though we know you'll love to show it off) – It provides a durable, convenient work surface so you can perform jobs on-the-go. Each cabinet is protected by HMC's high security tubular

locking system and the peace of mind our 5 Year Limited Warranty provides. Quality, strength, and dependability... You asked, and we listened.

We also listened when you asked if it was possible to bring the same high-quality, performance, and value

to our reliable line of carts. Our answer: Enter the all-new 32-inch 4 Drawer Slide-Top. This product offers the best qualities of our 56" Rolling Cabinet, streamlined into a deluxe service cart package. It's all there: heavy duty 5x2-inch casters, full-length padded push handle, ball-bearing drawer glides, and enough storage space to ensure that you'll be prepared to tackle any job. The slide top design comes together (quite literally) to create an ample work surface. A pull out drawer allows for the storage of and quick access to larger equipment. The lockable, peg-boarded side compartment keeps valuable tools hanging safely: there are even hanging bins for small parts! You'll simply be amazed at how versatile - and valuable – our new cart is.

These products are there when you need mobile storage that's as demanding as you are. We also offer a variety of options to suit all your needs. So call us today or visit our website to invest in a professional grade product from a company that knows nothing else.

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COMPLETE TIGHT SPACE REPAIRS FASTER

As technology advances, automobiles get smaller and more complex. Technicians need the convenience and versatility offered by compact cordless tools to access repairs in tight spaces like dashboards, door panels and bumpers. As a result, Ingersoll Rand turned its attention to the needs of the compact market and developed a line of 12V cordless tools.

The new Ingersoll Rand IQ^{V12} Series cordless tools enable technicians to access narrow spaces faster and easier. The IQ^{V12} Series includes three Impacttools™, two ratchets, a drill/driver, a screwdriver and an LED task light. Each tool in the line is powered by a 2.0 Ah 12V lithium-ion battery and delivers exceptional comfort, durability and accessibility.



Built for Comfort

Technicians put in long hours in the garage and can experience fatigue from heavy equipment and tools, repetitive motions, overhead repairs and vibrations. The IQ^{V12} Series cordless tools are lightweight and designed with small-diameter handles, which make them more ergonomic and comfortable to use. Most IQ^{V12} Series cordless tools feature

a comfort grip to help reduce tool vibration during extended use, allowing technicians to work longer, which helps them complete jobs faster. In addition, the D1130 drill/driver was tested on a hard joint, so technicians experience less feedback when drilling on a hard application surface, like sheet metal.

Manufactured for Durability

Life in the garage can be tough on tools. The IQ^{V12} Series tools are manufactured with a chemical-resistant housing to protect against wear caused by potentially harsh fluids. Every cordless tool's battery has a positive-lock feature that emits a click to let the technician know when the battery is properly secured, helping to protect against drops and damage. In



addition, every tool in the line has a three-point rubber grip to prevent scratches on the tool or work surface. The IQ^{V12} Series W1130 3/8-inch, W1120 1/4-inch and W1110 1/4-inch quick change hex Impacttools have all-metal mechanisms, and the R1130 3/8-inch and R1120 1/4-inch cordless ratchet wrenches have all-metal gear trains to increase the life of the tool.

Designed for Accessibility

It is often difficult to reach small fasteners or drill spot welds around the bumper, but the compact IQ^{V12} Series tools make it easier for technicians to access tight spaces. Ingersoll Rand designed the IQ^{V12} Series R1130 3/8-inch and R1120 1/4-inch cordless ratchet wrenches with a patent-pending slim-line battery to maximize reach, and a paddle-style trigger that allows for easy operation in a variety of grip positions and angles. Both ratchets deliver up to 30 foot-pounds of torque and have durable heads to handle additional manual ratcheting when the application demands it.

The cordless design of the IQ^{V12} Series gives technicians the versatility to work on large or damaged vehicles outside the shop. It also provides the convenience of completing dashboard repairs without pulling a compressed air line through the car.

The IQ^{V12} Series will be on display at the 2013 SEMA Show, Tuesday, Nov. 5 through Friday, Nov. 8. Demo the tools in booth No. 10149 and learn more about the new cordless line at ingersollrandproducts.com.



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Ten years ago, Ingersoll Rand launched the 2135TiMAX 1/2" air Impactool™. Today, it's still making an impact as the top-selling Impactool in the world. A lightweight, durable titanium hammer case helps the 2135TiMAX deliver the best power-to-weight ratio in its class. Celebrate the 10th anniversary of Titanium with this limited-edition package.

Contact your Ingersoll Rand dealer to learn more.

Includes:

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- Flashlight
- Decal

MAX POWER

1,100 ft-lb of nut-busting torque from a tool weighing less than 4 pounds — that's the best power-to-weight ratio in its class.

MAX CONTROL

Feather-touch trigger, wider range of power regulator settings in forward, always max power in reverse, patented one-hand forward/reverse control.

MAX RELIABILITY

FREE 2-year limited warranty with tool registration.

TITANIUM 10

SWEEPSTAKES

ENTER FOR YOUR CHANCE TO WIN!

Find a Registration Code in the box of your new 10th Anniversary Titanium 2135TiMAX Impactool and head to TITANIUM10.com to enter!

2 GRAND PRIZES: Win one of two weekend trips to the races in Daytona Beach, Florida, happening February 21–24, 2014!

250 INSTANT-WIN PRIZES: \$25 gift certificate for exclusive racing merchandise!

Sweepstake registration open 08/01/13 – 11/30/13. No purchase necessary. Void where prohibited. Visit TITANIUM10.com for more details. © 2013 Ingersoll-Rand Company

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TEST A TRAILER WITHOUT THE TRUCK

IPA® is proud to introduce the Light Ranger MUTT® (Mobile Universal Trailer Tester®), a rugged and portable trailer tester that allows the user to perform all testing functions without the use of the vehicle. The Light Ranger MUTT simulates all electrical circuits of standard towing vehicles for light Utility, Boat, RV and similar trailers using 7 spade, 6 round and 4/5 flat pin connections.

Designed for both technicians and owner operators, the Light Ranger MUTT is built to withstand the rigors of the shop or field with the use of quality components and a water resistant, compact enclosure that is large enough to hold a standard motorcycle type battery (battery not included). With a battery installed, the Light Ranger will provide hours of testing and can be used as a memory saver or power source for 12V DC low amp draw equipment, such as test lights, chargers, etc., via its external 12V power port.

Included with the Light Ranger MUTT is a three-way adapter, which converts the standard 7 Spade (RV) Pin plug down to 6 Round and 4/5 Flat Pin connectors to cover the entire range of light duty trailer configurations in North America, and a 500mA battery trickle charger.

Anybody who has tackled trailer wiring problems knows all too well the headaches that are associated with getting the job done. From a diagnostic standpoint, trailer wiring should be simple; however, the reason repairing trailers often proves to be so difficult stems from all the unknown variables. Say a customer drops off a trailer with a malfunction and he has already tried multiple tow vehicles, ultimately assuming the problem is with the trailer itself. To start diagnosing the issue, you first need to isolate the trailer from all known variables, e.g. the tow vehicle, poor power supply, wrong wiring configuration, malfunctioning brake controller, just to verify that the customer's assumption is correct.

The Light Ranger MUTT provides the solution to this problem. It eliminates the need for a tow vehicle while simultaneously providing a good power supply, correct configuration, proper ground, full available energy for the electric brake circuits and short circuit protection. Reasons for failure in trailer electrical systems come in many varieties: corrosion, shorts, crossed or cut wires, bad grounds, improperly wires harnesses and component failure (light bulbs or brakes). Fortunately, the five for the majority of these issues is relatively quick.

Once you plug in the Ranger MUTT, rotate the control knob to each individual circuit and walk around the trailer to ensure the selected component (lights or brakes) operates as normal. If a circuit does not perform as expected, check all electrical connections points starting with the harness, back



to the lights, brakes, chassis grounds, etc. The Light Ranger MUTT features an internal automatic circuit breaker, which will trip when a short or overload is found. This aids in troubleshooting short circuits by allowing you to chase down the short without blowing fuses. The Ranger MUTT will also power and activate electric brakes if equipped, which will allow technicians to confirm proper electrical/mechanical function and ensure a safe trailer is returned to the customer.

The Light Ranger MUTT is an incredibly convenient package at a price point that is ideal for those using or working on trailers. Whether it be for work or play, on the farm or at the lake, the Light Ranger MUTT will ensure your trailer is functioning properly. Built proudly in the USA, the Light Ranger MUTT is available through professional tool distributors nationwide.

Innovative Products of America, Inc. (IPA®)
234 Tinker Street
Woodstock, NY 12498
845.679.4500 ■ www.ipatools.com

FUTURE NOW®
IPA®

Original Equipment Manufacturer (OEM) USA

TEST YOUR TRAILER WITHOUT THE TRUCK

LIGHT RANGER MUTT® #9101

NEW

- Portable, water resistant trailer tester for lights and electric brakes
- Tests 7 spade, 6 round and 4/5 flat pin trailer side harnesses
- Short circuit protection
- Turn signal simulation and power verification LED
- Internal battery compartment



Battery Not Included



Includes: Trickle charger and trailer plug adapter



CHASE DOWN SHORT CIRCUITS WITHOUT BLOWING FUSES

Fuse Saver® Master Kit #8016

- 5-30 amp breaker handles



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ELIMINATE MISTAKES WHEN PERFORMING ENGINE SETUP PROCEDURES

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- Focused high pressure output
- Available in four sizes: 12", 24", 26" and 36"

5X
the air volume



TIRE SERVICE TIPS FROM COATS

Hennessy Industries is the maker of Coats™ and BaseLine® by Coats tire service equipment, as well as Ammco brake lathes and BADA wheel weights. Our team of engineers is constantly evaluating how to make the tire changing and wheel balancing processes simpler, easier, and faster so you can get the job done right the first time. Here are a few tips from our experts on how to best service tires.

Tire Changer Tips

▪ A very wise man once said, “Lube is your friend.” Insufficient lubrication can result in bead distortion or other tire damage.

Conversely, excessive lube or an improper mixture could result in tire slippage. Be sure to not only apply it to the tire bead, but also to the bead seat and drop-center areas of the rim.

▪ Another very wise man once said, “Sometimes you have to slow down to speed up.” Take your time when servicing challenging applications, like ultra-high performance tires. Check for TPMS sensors. Let the top bead relax a little during the mounting process. Use all the helper devices at your disposal. The result will be consistent output of quality work and less variation in your tire service process.

▪ If you've invested in a tire changer with a wheel lift, use

it when servicing ultra-high performance tires or custom wheels. You may be faster than the lift but research shows that most wheel damage occurs while mounting the wheel on the machine. Using your wheel lift will save money on damaged wheels, avoid embarrassing customer situations, and help error-proof your mount/demount process.

Wheel Balancer Tips

The goal here is straightforward... to provide the customer a vibration-free ride on the first attempt. And that process begins at the wheel balancer.

First and foremost, you must be certain that you mount the tire and wheel assembly on the balancer in the exact same manner that it will be mounted back on the vehicle. Consider this example. A 16" diameter 7" wide wheel mounted and balanced just .010" off-center on the balancer shaft will result in a .85 oz. static vibration when mounted

back on the vehicle. The balancer will assume that you've centered it properly and report a balanced wheel. Process errors such as this one are easy to make, and are responsible for upwards of 60% of vibration-related tire service comebacks. The good news is that they are easy to avoid.

▪ First, monitor the condition of your mounting cones and replace them when they begin to appear nicked or worn.

▪ Second, invest in a set of mounting adapters such as pin plates or fixed finger plates. These adapters engage the wheel in its lug holes, and when used in conjunction with mounting cones, provide an almost error-free method for mounting.



Designed for the needs of tire dealers, Coats tire service equipment has led the market for more than 60 years, becoming the industry standard for durability, reliability, and ease of use.

Designed for the needs of repair shops, BaseLine by Coats tire service equipment is feature-rich and ruggedly-built for repair shops who demand high quality without the high price. It's something we like to call PREMIUM VALUE, where performance isn't sacrificed by price.

Visit www.ammcoats.com to learn more about Coats and BaseLine by Coats tire service equipment.

Coats Tire Services Equipment
BaseLine by Coats Tire Services Equipment
Hennessy Industries, Inc.
www.ammcoats.com
1-855-876-3864

BASELINE™
BY COATS®

COATS
Working for you

MAKING SENSE OF TPMS SENSORS

The introduction of tire pressure monitoring systems has created a new set of challenges for shop owners, technicians and even consumers. It is estimated that more than 64 million vehicles are equipped with TPMS in the United States. This number can be staggering when you consider that not all TPM systems are created equal. With every new model year, shops are being challenged with new technologies such as relearn/reset and diagnostic procedures, as well as an increase in the number of OE part numbers needed to service these vehicles.

With original equipment TPMS manufacturers representing over 150 different TPMS transmitters, the challenge for aftermarket shops is how to best manage their TPMS inventory. Improper inventory management can mean money tied up in transmitters that are rarely used, or idle service bays while waiting for local delivery. In this increasingly competitive industry, the most significant impact is the potential for lost sales. Fortunately, technological advancements incorporating programmable and universal TPMS transmitters are making it easier for technicians to service vehicles, while requiring shops to carry less TPMS inventory.

The idea behind this new technology is simple: create a "blank" transmitter that can be programmed to a specific vehicle at the time of sale. It combines the functionality of over 150 original equipment transmitters into as few as two part numbers.

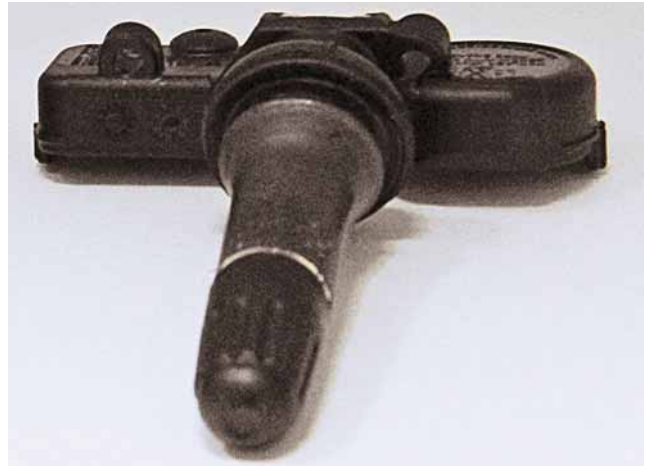


WRT500

Mighty Auto Parts has partnered with Schrader International and Bartec USA to offer a complete TPMS program. Schrader, a leading manufacturer of original equipment TPMS transmitters, has created EZ-sensor™, programmable transmitters that provide over 85% coverage of popular applications. Using a Bartec TPMS tool (WRT400SD or WRT500), technicians can program the blank transmitter with the exact protocol for that specific vehicle. Two EZ-sensors are required to cover both a 315 MHz and

433 MHz frequency transmitter. Once programmed, the transmitter is ready to be installed using their patented snap-in valve (see picture), or optional aluminum clamp-in valve (P/N 34000ZZ).

Mighty has partnered with other companies to offer options in programmable TPMS transmitters. 31 Incorporated, for example, has developed the Smart Sensor programmable sensor. This program incorporates two different programmable units (315 MHz and 433.92 MHz), and offers coverage up to



EZ-sensor™ (315MHz)

90% for domestic and import vehicles. The Smart Sensors require a specific programming tool (P/N 17-144), which can also be used to relearn many traditional TPMS vehicles.

Also available are universal aftermarket transmitters that do not require programming prior to installation. They are manufactured with the necessary protocols required to operate a given number of vehicle applications. When installed, universal transmitters broadcast each protocol until the vehicle recognizes the correct one. The primary advantage continues to be expanded coverage with limited part numbers.

The average life expectancy of batteries powering OE transmitters is approximately seven years. Since many of these transmitters are reaching that age, the timing could not be better for offering a lower cost alternative. Programmable and universal transmitters save time and reduce the number of part numbers necessary to provide expanded coverage. Ultimately, the shop is able to offer their customer full tire-related service and reduce the risk of a lost sale.

Mighty Auto Parts, 650 Engineering Drive, Norcross, GA 30092; Phone: 1-800-829-3900; Fax: 770-446-8627

Website: www.mightyautoparts.com

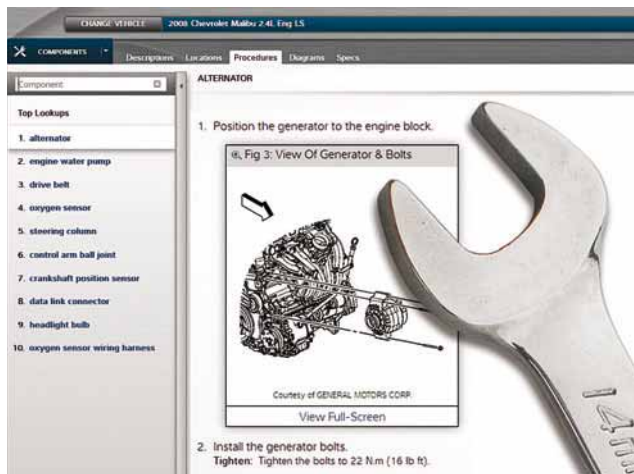


WORK MORE EFFICIENTLY WITH COMPLETE REPAIR INFORMATION TOOLS

Imagine this scenario: the clock is ticking and your customer is coming to pick up the car soon. You've spent way too much time troubleshooting the vehicle and nothing is working. You are stumped. Ever been there?

Now imagine this: before you get to that point, you have access to a complete repair information resource that combines OEM information as well as diagnostic tools and real fixes from technicians who have faced the very same problem that you have in your bay. Would that make your job easier?

Having complete tools lets you work more efficiently. You wouldn't work well with half a wrench, and it's the same with your repair information. That's why Mitchell 1 put OEM and experience-based repair information together in a complete, streamlined solution: ProDemand™ with SureTrack™.



In a single lookup, ProDemand delivers repair procedures, specs, component locations, wiring diagrams, recalls, TSBs and fluids information for most every manufacturer. That eliminates the need for multiple searches, so you can spend your time repairing the car, not searching.

And SureTrack is just a click away, providing resources like commonly replaced parts data, diagnostic troubleshooting tools, and repair tips and real fixes from an interactive community of expert technicians. So, if you encounter a tricky vehicle problem that defies all the standard steps to diagnosis and repair, you can post your question to the SureTrack community. You'll get ideas and quick fixes by email – without

having to wait by the phone -- often within minutes of sending your question.

There are lots of features in ProDemand that boost efficiency, but here are five specific ways that ProDemand delivers the industry's most comprehensive repair information:

1. Complete OEM Information

Mitchell 1 covers most every OEM, and has for over 80 years.

2. Experience-based Information

SureTrack adds to the power of ProDemand with exclusive expert-based knowledge, detailed parts replacement records and guided component tests, all wrapped in an interactive community.

3. Latest TSBs

Most OEM TSBs are in ProDemand within two weeks of publication date. There's no need to search the Internet for the latest TSBs—they're already right where you need them.

4. Industry-leading Wiring Diagrams

Mitchell 1's best-in-class Scalable Vector Graphic (SVG) color wiring diagrams are created with a consistent style across all OEMs, making them straightforward and easy to use.

5. Integration with Shop Management

With a single click in Manager SE™, Mitchell 1's industry-leading shop management system, techs have direct access to the contents of ProDemand, including estimating, maintenance, service, fluids and TSB information.

With decades of total coverage, ProDemand not only makes your shop more complete, it gives techs the added tools and confidence to perform at their full potential.

To get the complete story, visit www.mitchell1.com or call 888-724-6742.



NAPA FILTERS FAMILY OF PRODUCTS

NAPA's Family of Filters was created to meet the changing demands of the automotive aftermarket consumer.

With changes in engine and motor oil technology, NAPA Filters offers three levels of oil filters. Each one has been designed for a specific way DIY customers change their oil. What DIY consumers said they really wanted to know was simply, "What's the right filter for me?"

NAPA's Family Of Filters: Designed For Your DIY Retail Customer

Today's DIYer can choose from a standard, premium or ultra-premium filter that fits their specific needs. There is a NAPA Filter designed to specifically fit any of the following scenarios:

- Changing oil every 3,000-4,000 miles or 3-4 months
- OEM recommended change interval
- Harsh daily driving conditions
- Use of synthetic oil

SilverNAPAFilters™

The Silver Oil Filter is NAPA's Standard Filter recommended filter for traditional oil change intervals (3-4 months or 3-4,000 miles) or when a DIY customer needs a bit more engine protection because they don't always meet that change exactly at 3-4,000 miles or 3-4 months.

SILVER OIL FILTER: This features Cellulose Media – 10 percent more cellulose than the traditional economy filter, nitrile anti-drain back valve* and safety by-pass valve*. The Silver NAPA Filter is the best filter in NAPA's Family of Filters when using conventional motor oils.

SILVER AIR FILTER: NAPA's Silver Air Filter prevents dirt and dust particles from damaging cylinder walls, pistons and piston rings which can reduce engine performance. NAPA's Silver Air Filter offers coverage for most popular applications in the retail segment.

GoldNAPAFilters™

The Gold Oil Filter is NAPA's Premium filter recommended for DIY customers who rely on their vehicle's OEM recommended oil change interval, but also want better engine protection than is offered by a lesser quality economy filter.

GOLD OIL FILTER: Glass-enhanced cellulose media traps and holds 50 percent more contaminants than traditional economy oil filters. Silicone anti-drain back valve* will not harden and become brittle, providing greater value and protection over a standard Nitrile valve used in a lesser quality filter. A safety by-pass valve* insures continuous oil flow during cold engine starts. The Gold NAPA Filter is the best filter choice in NAPA's Family Of Filters when using high mileage or synthetic blended motor oil.

GOLD AIR FILTER: NAPA's line of Gold Air Filters sets the GOLD STANDARD in aftermarket air filtration. With 9-PPI, a more robust, upgraded water and snow tolerant media that prevents dirt and dust from damaging cylinder walls, pistons and piston rings. A NAPA Gold Air Filter means better filtra-

tion and longer engine life. NAPA's line of Gold Air Filters offers superior application coverage for both passenger cars and light trucks – foreign or domestic.

PlatinumNAPAFilter™

The Platinum Oil Filter is NAPA's Ultra-Premium oil filter recommended for the DIY retail customers who use fully synthetic motor oils or drive their vehicles through harsh or severe driving conditions.

PLATINUM OIL FILTER: *Examples: towing heavy loads, higher oil temperatures or long idling periods.* This features wire-backed, reinforced, fully synthetic media and hydrogenated Nitrile Butadiene Rubber (HNBR) sealing gasket improves durability at high operating temperatures. The silicone rubber anti-drain back valve* will not harden and become brittle, providing greater value and protection over standard nitrile valves used in a lesser quality economy filter. A safety by-pass valve* insures continuous oil flow during cold engine starts. The Platinum NAPA Filter is the best oil filter choice in NAPA's Family of Filters when using fully synthetic motor oils or dealing with severe or harsh driving conditions.

* Where applicable

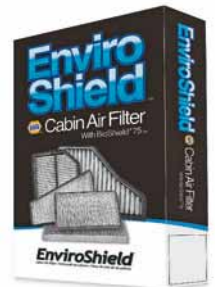


EnviroShield™ Cabin Air Filters

An EnviroShield Cabin Air Filter with BioShield75™ removes microscopic dust, allergen, pollutants, mold and other particles from the air that flows into a vehicle's passenger compartment. Cabin air filters are designed to keep the air that flows into a vehicle's passenger compartment cleaner and healthier. A clean, new EnviroShield Cabin Air Filter with BioShield75 is also an important element for maintaining a properly working HVAC/AC system.

All EnviroShield Cabin Air Filters with BioShield75 have a unique, patented coating applied only to NAPA cabin air filters. BioShield75 has the ability to destroy harmful mold, bacteria, allergens and other pathogens that none of our competitors offer.

NAPA's line of EnviroShield Cabin Air Filters with BioShield75 has an extensive application coverage, with over 200 part numbers for passenger cars and light trucks, including both foreign and domestic vehicles. NAPA Filters recommends cabin air filters be changed at least every 12,000 miles or 12 months or even sooner if the vehicle is driven in a very dusty or dirty environment.



ORIGINAL EQUIPMENT FOR THE AFTERMARKET

There'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.



KYB
World Class Shocks & Struts



Original
Equipment
for the Aftermarket[®]

KYB[®]
World Class Shocks & Struts



Original
Equipment
for the Aftermarket[®]



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!

Please visit us at www.kyb.com to learn more

DEALING WITH DIFFERENCES OF ELECTRIC DRIVE VEHICLES

Technicians today are faced with the ever-changing requirements of working on new technology vehicles. In response to the tremendous number of new technology vehicles on our road today, the National Alternative Fuels Training Consortium, a program of West Virginia University, has rolled out an in-depth Electric Drive Vehicle Automotive Technician Training to help educate today's automotive repair workforce on these vehicles.

This 40-hour class combines general and original equipment manufacturer (OEM) specific lessons and skills to safely diagnose, disassemble, and repair electric drive vehicles. The course is evenly distributed in both classroom and shop activities.

A key portion of the shop activities involves training participants on how to safely work with the high-voltage system. Many current automotive technicians may be unfamiliar with the differences between low-voltage DC and high-voltage systems, and the course spends extensive time emphasizing safe work practices in dealing with these systems on electric drive vehicles.

One of the most liked and informative shop tasks conducted in the new course involves the safe and non-intrusive removal of a hybrid vehicle's high-voltage battery pack. In using the proper tools, techniques, and proper personal protective equipment (PPE), including high-voltage insulating gloves and leather over-gloves, participants are able to incorporate many lessons and technical instructions learned during the course of the training into an intense, yet educational task.

Technicians begin the battery pack exercise by removing batteries from various electric vehicles. As a mini-exam, participants are instructed to map out the battery pack individual modules, high-voltage bus, relays, and other related systems in a rough drafting exercise to fully emphasize their learned knowledge of the battery pack, interlock systems, relays, and voltage transfer systems.

Another shop activity conducted during the course is the "high voltage system isolation fault detection" task. In the picture to the right, team members are shown looking up the diagnostic trouble code (DTC) P0AA6 on Toyota's Technical Information System (TIS) website for a detailed explanation of Hybrid Battery Voltage System Isolation Fault. P0AA6 may set with a number of information codes, such as 526, 611, 612, 613, and 614.

For this class, the students were divided into teams of four or five, with each team getting exclusive use of a hybrid vehicle and a factory scan tool. Each team was equipped with a pack of resistors with specific instructions on how to safely place a very high value resistor between one of the high-



voltage battery's individual modules and the auxiliary 12 volt battery negative terminal. This action is performed to create a high-voltage leakage to ground.

After the fault circuit was performed, the students were instructed to perform a health check of their vehicle using a computer scan tool. The high resistance resistor initially set a Diagnostic Trouble Code (DTC).

This activity, as well as many of the other extensive hands-on tasks students experience in the Electric Drive Vehicle Automotive Technician Training, prepares students for future exploration of information available in the scan tool, including the next step of monitoring the systems Parameter Identification (PID) codes.

For more information on the Electric Drive Automotive Technician Training visit www.naftc.wvu.edu or call 304-293-7882.

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Instruction Includes:

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- Presentations/Animations
- Videos
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- In-depth Scan Tool Training
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- Exams/Practical Exercises
- Surveys

The 40-hour **Electric Drive Vehicle Automotive Technician Training** instructs participants on the fundamentals, system design, diagnostic considerations, and special service topics of **HEVs**, **BEVs**, **PHEVs**, and **FCEVs**. The course covers appropriate safety measures in maintaining electric drive vehicles and describes their electric drive systems including construction, operation, control strategies, factory scan tools, scan tool data, and diagnostic fundamentals. The primarily hands-on

**Training
with Impact**

training is based on an intermediate technician level and will give participants the knowledge to diagnose and repair electric drive vehicles.

Educating America on Next Generation Vehicles

Acknowledgment: This material is based upon work supported by the Department of Energy Office of Energy Efficiency and Renewable Energy under Award Number DE-EE0002108.



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Phone: (304) 293-7882 • Fax: (304) 293-6944



A Program of

 West Virginia University

www.naftc.wvu.edu

SKF OFFERS FRONT HUB BEARING ASSEMBLY TIPS FOR 2007 MODEL YEAR GM TRUCKS

In this technical bulletin, SKF explains how identifying the correct truck platform and body style for 2007 model year GM Chevrolet and GMC trucks will help ensure the correct choice for hub unit replacement.

During model year 2007, GM made a mid-year model change. They carried over the GMT 800 platform/body style and labeled these trucks as “classic” style. The same year they introduced the GMT 900 platform/body style, labeled as “new” style.



Figure 1

The front end design of the two body styles is noticeably different. One of the standout features is the headlamps. The GMT 800 “classic” style has a filler plate between the headlamp modules, while the GMT 900 “new” style has a one-piece assembly. See figure 1 and 2 to help identify the correct body styles.



Figure 2

To further identify the correct hub unit for replacement, you can also distinguish a visual difference in the ABS cord on the hub units. The “classic” style (GMT 800) has a passive ABS system and a thicker

ABS cord than the “new” style (GMT 900). The “new” style has an active ABS system and thinner ABS cord.

Here are the part numbers for the 2007 GMT 800 and GMT 900:

2007 GMT 800 platform “classic” style

- 1500 4x4 BR930304
- 2500 4x4 and 4x2 BR930626
- 3500 4x2 w/9900 BR930626
- 3500 4x2 w/12,000 G.V.W. BR930667
- 3500 4x4 BR930667

2007 GMT 900 platform “new” style

- 1500 4x4 BR930661
- 2500 4x4 and 4x2 BR930662
- 3500 4x2 w/std. sup. BR930662
- 3500 4x2 w/HD sup. BR930783
- 3500 4x4 BR930783

Interested in additional technical information? SKF offers a number of learning channels to help technicians stay informed.

SKF Training Trucks

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. SKF training trucks enhance your knowledge of SKF products and teach you how to educate customers about the differences between SKF premium hub bearings and competitor components. Contact your local SKF representative to book an SKF training truck at your location.

SKF Social Media Program

A newly launched Twitter page and YouTube channel provide access to the latest training and installation videos, technical tips and product information 24/7. Follow us to receive the latest updates! [@skfpartsinfo](https://twitter.com/skfpartsinfo) www.skfpartsinfo.tv

SKF Pole Position Program

As a member of the Pole Position program, installers receive a periodic e-newsletter containing exclusive updates regarding the latest SKF news, product information and technical tips – all designed to help maintain a productive and profitable repair business. Additionally, participants have the opportunity to redeem applicable bar codes for premiums, consisting of racing merchandise and tools for the shop. Complete the Pole Position sign-up form at www.vsm.skf.com to start receiving member benefits today.

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

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



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.

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.

YouTube www.skfpartsinfo.tv  [@skfpartsinfo](https://twitter.com/skfpartsinfo)



The Power of Knowledge Engineering

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SKF®

GM CONCENTRIC SLAVE CYLINDER BLEED PROCEDURE

If you have been installing clutches for a while, you are probably familiar with the Ford Ranger concentric slave cylinder and the difficulties and uncertainty presented when attempting to bleed it. Unfortunately, General Motors has followed similar suit with other concentric slave cylinders. Most General Motors vehicle designs do not provide access to the slave cylinder without removing the transmission from the engine. Additionally, some models do not have bleed ports.

To assist with bleeding these problematic slaves, the steps outlined below detail the proper procedure to correctly bleed the system while the transmission is off the vehicle.***

- 1.) Verify that the clutch master cylinder has a full fluid fill. If not, add additional fluid until full.
- 2.) Insure that the clutch master cylinder is mounted level on the firewall. Some vehicles may require the master cylinder to be unbolted, leveled and re-mounted to the firewall.
- 3.) Install the concentric slave cylinder on the transmission. Note: Some slave cylinders have the input shaft seal built in. (fig. 1) This seal **MUST** be lubricated! Failure to lubricate will result in seal damage and leakage.
- 4.) Lift the transmission up into the vehicle but do not mount the transmission to the engine. With the transmission lifted, reach up and connect the hydraulic line to the slave cylinder.
- 5.) Once the slave and hydraulic line are connected, reach into the bell housing and push the slave cylinder back in its bore (fig. 2), then release and let it return to its original position. (fig. 3) Repeat this process 12 – 15 times. Following this procedure will force any air trapped in the hydraulic line back up through the master cylinder, through its vent cap and out of the system. Bleed complete.

***This procedure will work on ANY concentric slave cylinder application. It is the **ONLY** way to bleed many newer applications that do not have bleeder valves.



Figure 1



Figure 2



Figure 3

COMPLAINT, CONNECTION, CAUSE, CORRECTION – WHAT’S YOUR DIAGNOSTIC PROCESS?

The computer controls in today’s vehicles and the tools for diagnosing them are better than ever. From simple OBDII code readers for basic emission work, to complete, handheld diagnostic and information systems that can diagnose modules and sensors throughout the vehicle. There are tools suited for every type

of work and every technician skill level. Diagnostic tools are required for most repairs, including jobs like brake pads, tires and alignment, which were previously purely mechanical.

Retrieving the codes and data that give technicians clues to a problem is only the first step to a repair. Relearns, coding, adaptations, plus validation tools like functional tests and component tests are required to complete the job. Using your tools, training and expertise to verify the root cause is where experience makes the difference between a long chase and a fast, certain fix. How do you handle a specific vehicle or problem the first time you see it? It helps to have solid experience and a disciplined process to get from the complaint to the cure.

So how can you tap into the experience of millions of repairs by OEM and specialty shops right from your service bay? The most productive technicians turn to an experience-based information resource to save time and increase confidence in their diagnosis. For over 20 years, Snap-on has been building the exclusive database of Fast-Track® Troubleshooter tips and Guided Component Tests, to give technicians the benefit of experience at their fingertips.

Experience-based tips are a tremendous value the first time you see a specific problem or a specific vehicle. Chances are someone has diagnosed a similar problem and a similar vehicle. And symptom tips provide insight even when the problem does not trigger a fault code.

A single problem can be caused by a wide range of vehicle faults. So a symptom or code doesn’t always tell the whole story. Let’s look at a typical challenge that appeared in one of our customer’s bays:



▪ A 2007 Toyota Prius was towed in for a no-start condition, and showed several seemingly unrelated codes for information mismatch, poor engine power, low fuel level and the throttle pedal.

▪ The technician replaced the pedal/sensor assembly. The vehicle still would not start.

▪ The technician was ready to tow the vehicle to the nearest dealer, a half hour away, when another technician said “let’s check Troubleshooter first.”

▪ A Fast-Track Troubleshooter symptom tip for a hybrid vehicle “No Start” condition indicated that the “Ready” light may fail to activate if the vehicle had previously been run out of fuel. This problem simply requires codes to be cleared from the hybrid control HV ECU, hybrid control HV battery, and the engine ECU. But the codes must be cleared in that specific order. Problem solved!

An expert information resource like Fast-Track Troubleshooter can give insight to the most likely cause of a problem as well as the fastest way to verify and repair it. Avoid wasted time, prevent wasted parts, and keep the job in house. All good reasons to check Troubleshooter before jumping to conclusions.

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Snap-on®

FORD BANDED SENSORS

In 2006, Ford passenger cars and trucks were equipped with TPMS systems that had wheel mounted sensors banded to the middle of the inside wheel rim. The banded sensor mounting technique utilizes a retaining clip, band and cradle instead of the more common valve stem mounting process.

Today, the cradle is no longer being used solely for Ford banded sensors. The addition of the “thumb” (circled) allows rubber snap-in and aluminum clamp-in sensors to be used in various applications. The snap-in or clamp-in sensor can now be secured in the “thumb” hole, adjusted to a 20 degree angle and banded to the middle of the inside wheel rim. Using this method allows technicians the flexibility to move original sensors from one size wheel to another larger or smaller wheel without having to worry about different stem angles required on certain wheel applications.

About Standard TPMS Technology

As a leader in TPMS technology, Standard provides more than 98 percent full-line coverage. Standard TPMS sensors are engineered to match OE fit, form and function, plus they have the technology to be ID cloned to the sensor they replace using a simple TechSmart cloning tool. Each clone-able sensor has its own unique sensor ID, the right protocol and matching body style. Standard clone-able TPMS sensors offer the technician the advantage of bypassing complex factory relearn processes, therefore saving time and money while maintaining OE fit, form and function.

One of these tires is dangerously under-inflated

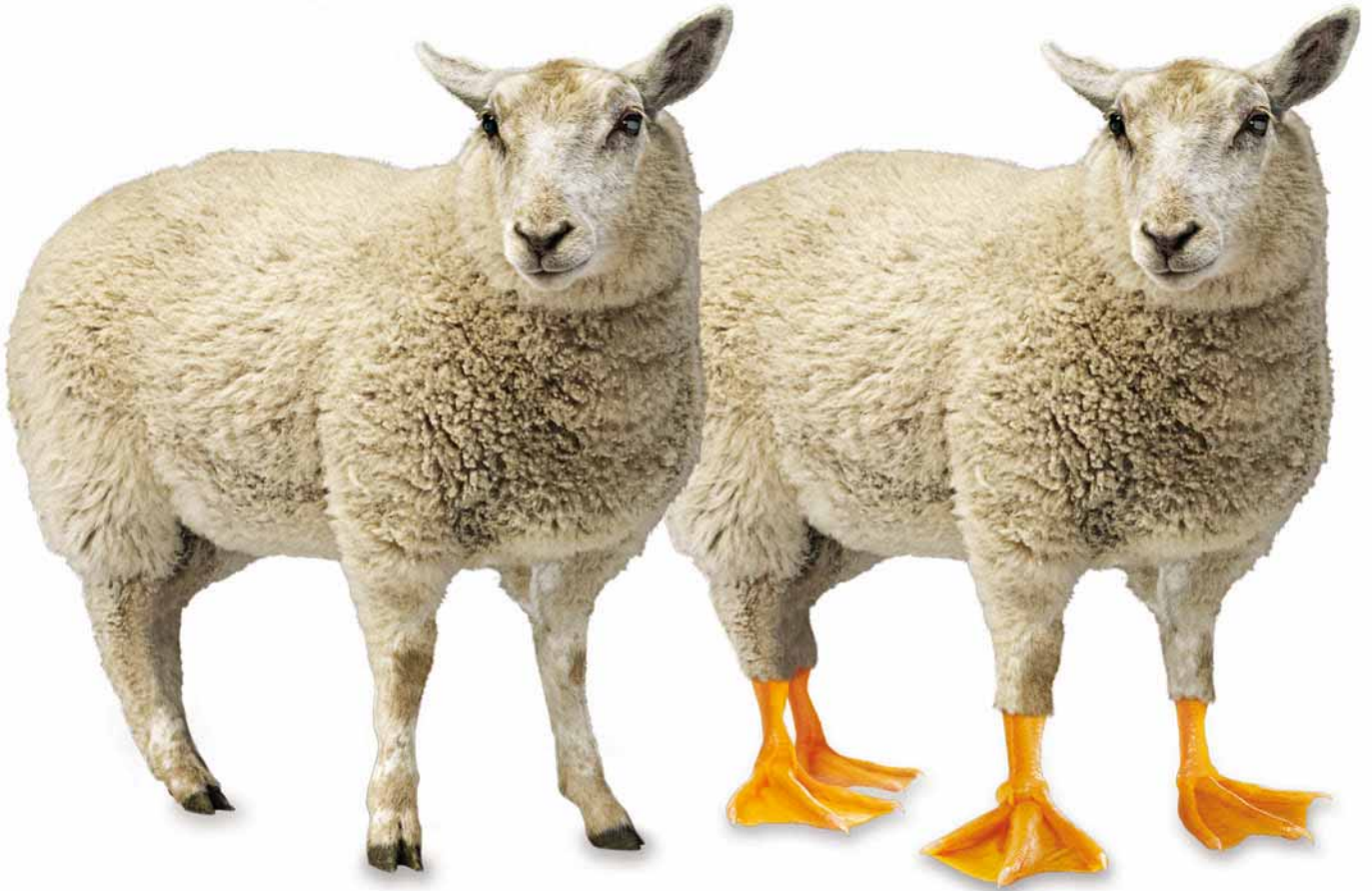


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TRICO: THE LEADER IN WIPER INNOVATION

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

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

Original Look, Superior Performance

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

The TRICO Factory Replacement Center features a newly expanded line of TRICO Exact Fit blades including beam, hybrid, conventional and rear blades that provide unmatched coverage for nearly 99 percent of consumer vehicles on the road today. Leveraging TRICO's close relationships with OEMs, TRICO Exact Fit blades offer the fit, form and function of original equipment right out of the package.

TRICO now offers five new TRICO Exact Fit rear windshield beam blades to fit 2004 through 2014 models of Audi, BMW, Ford, Volkswagen and Volvo vehicles. The new line features five arm designs including V-Notch, Cross Pin, Push Button, Pinch Tab and Trunnion.

To make installation a snap, TRICO Exact Fit wiper blades are pre-assembled with the specific adaptor for the consumer's vehicle, eliminating the fuss of multiple adaptors and complicated instructions.

A Winter Weather Fighter

Although beam blades are considered an all-season wiper, TRICO invented the winter blade in 1953 and has recently perfected it with TRICO Ice[®]. This all-new, winter weather blade provides maximum performance in the most unrelentingly harsh conditions.

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



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

Many Options, One Single Resource for Wiper Products

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

Trico Products

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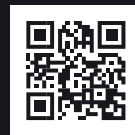
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- Sleek, wedge-shaped spoiler clears away snow and ice



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tricoproducts.com/ice

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seeing you through.

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PROPER GREASING FOR A SYNTHETIC BEARING

It's easy to over-lubricate low-friction components. Remember, when it comes to greasing synthetic bearing designs... less is more.

When installing low friction suspension components you will find that the amount of lubrication required is much less than traditional metal on metal bearing designs. The reason is due to the change in the bearing package within the low friction component.

Figure 1



In figure 1, the Raybestos chassis bearing package fills the entire cavity of the product. The grease grooves are manufactured into the bearing and not the ball stud. This design allows the lubricant to surround the entire ball. The bearing package is also impregnated with special materials that are self-lubricating.

In figure 2, the traditional metal on metal bearing package has void areas that need a larger amount of lubrication to fill these areas.

The proper amount of lubrication in the low friction component will deliver the best possible performance for that part.

The Trusted Choice of Expert Technicians

CNC machining ensures each part matches the dimensions and specific

technology of that vehicle. Ball and socket designs match each application for built-in strength and durability; patented designs are checked physically and electronically to maintain precise alignment tolerances.

Best Steering Performance and Ride Quality

Low-friction designs provide optimal turning torque. 80% of vehicles are designed with low-friction steering and suspension parts. If you replace a low-friction part with a high-friction metal on metal part, steering performance and ride quality will be compromised.

Bans Contamination for Longer Service Life

Permanently attached polyurethane dust boots are purgeable for consistent, long-lasting performance. Protective coatings prevent corrosion for the longest possible service life. The synthetic componentry is resistant to gasoline, oil, brake fluid, battery acid and road level ozone.

Strength and Durability that Defeats Road Shock

For applications with high loading capability, you need a replacement part that stands up to severe shock. High strength steel forgings and cold-formed, heat-treated studs ensure stability. Precision machined, polished full ball studs ensure full contact, which reduces wear and endplay. One-piece metal bearing designs deliver high load capacity and zero side-to-side endplay.

The Only Chassis Line Trusted by JGR

For reliable performance, all Joe Gibbs Sprint Cup Toyota racecars are also equipped with Raybestos Racing ball joints and tie rods. The premium-quality chassis parts help fine-tune each car's suspension setup for optimal grip and handling. The advanced technology that gives JGR its winning edge helps you provide your customers increased safety, smoother operation and extended service life.

The Best Parts and Labor Guarantee

Our advanced technology, low-friction designs reduce endplay and hold tighter alignment tolerances. We are so confident in their performance that, if any Professional Grade® chassis product fails, we will refund the cost of the part... plus the expense of your labor.

For information on Raybestos brand chassis parts, visit www.RaybestosChassis.com or call 800-323-3022.

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www.RaybestosChassis.com

TOYOTA PRIUS AND HYBRID DRIVE SYSTEMS TRAINING

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

Benefits of offering hybrid vehicle service include increased repair orders 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 establishing the business as a high-technology vehicle repair solution.

WTI's Toyota Prius and Hybrid Drive Systems class offers advanced-level training to equip students with the knowledge and know-how to service the Toyota Prius as well as other hybrid models such as the Nissan Altima and Ford Focus since these vehicles are manufactured using licensed Toyota hybrid technology. Students also obtain elaborate training materials and hands-on guidance to ensure skills learned in the classroom can immediately be put into practice back at the shop.

Learn how crank no-start problems can be challenging when dealing with a hybrid vehicle high-voltage (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. You can get a ready light (meaning the vehicle will still drive) but you're running on battery power alone. You will also have the red triangle light on.

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 debris can easily get lodged over the mass air flow (MAF) sensor and keep the engine from running. Dirty throttle bodies are also common due to the variable valve timing engine design.

Any of these scenarios may result in codes P3190, P3191 and P3101 letting you know the engine cranked but did not start. Unfortunately, using standard troubleshooting techniques to isolate the problem can complicate diagnostics or, even worse, compromise the vehicle itself. This is due to the interdependent relationship of these codes when dealing with the electric motor and HV battery of a hybrid.

Through professional training and experience, the majority of the major issues that can arise when dealing with these codes can be avoided by following a few simple but insightful steps: when diagnosing this problem check the oil level and drain some out if questionable, clean the throttle plate, clean the MAF sensor element, and check the codes and freeze-frame data in the HV ECU for the P3101. Learn this and more at the WTI Toyota Prius and Hybrid Drive Systems class.

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 and view all class dates and locations at www.worldpac.com/wti-prius.

WORLDPAC Inc.
37137 Hickory Street
Newark, CA 94560-5522
800-888-9982 ext. 5470

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



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For more information, visit
www.denso.com.

Denso

ROUGH SERVICE BULB

Philips Automotive North America offers its new Philips LED Rough Service Bulb for a variety of automotive service applications. This new light bulb features advanced LED technology, which the company says makes it extremely efficient and durable, especially in rugged environments. The light bulb is designed with an "instant on" feature, and delivers exceptionally bright lighting that easily can enhance any shop, garage or work area. The new Philips bulb needs only 10.5 watts of power, a fraction of the consumption required by conventional Halogen and fluorescent lamps.

For more information, visit
www.usa.lighting.philips.com.

Philips Automotive Lighting North America



WHEEL HUB ASSEMBLIES

Quality-Built, the smarter choice, offers a premium line of all-new wheel hub assemblies for automotive applications. Each hub assembly is subjected to a multi-point quality inspection to ensure trouble-free installation and durability for the life of the product, according to the company.

For more information, visit
www.motorcarparts.com.

Motorcar Parts of America

MAF SENSORS

All of Walker's MAF sensors are 100 percent new, not remanufactured. They are manufactured to meet or exceed OEM standards and specifications, the company says. Every shipment is tested in the USA against OEM units to maintain our high standards. We offer 132 SKUs covering more than 7,000 applications; more model coverage with fewer SKUs.

For more information, visit
www.walkerproducts.com.

Walker Products



FUEL INJECTOR CLEANERS

Rislone Fuel Injector Cleaner does much more than just clean an engine's fuel injectors. When used regularly, the company says the super-concentrated additive quiets noisy injectors and fuel pumps, soothes rough idle, eliminates hard starts, increases power and lubricates the entire fuel system. Plus, Fuel Injector Cleaner includes Rislone's proprietary Upper Cylinder Lubricant, which extends engine life. The benefits start in the fuel tank, where Fuel Injector Cleaner (P/N 4701) helps prevent rust and corrosion. It is compatible with modern fuels, including unleaded gas, flex fuel, E10, E15, E85, ultra-low-sulfur diesel and other bio blends.

For more information, visit www.barsproducts.com.

Bar's Products

12-VOLT STARTERS

Bosch makes available its Long Haul 12-volt series of starters that are specially designed to outperform and outlast their OE counterparts on most heavy duty commercial vehicles. Bosch says these starters include all the features necessary for the widest range of large displacement commercial diesel engine applications. Three Bosch Long Haul Starters replace more than 186 competitive part numbers. Other notable features include an easy-to-use Universal Mounting Flange reduces SKU count which, in turn, simplifies inventory; over crank protection prevents damage and ensures a longer life; internal magnetic switch (IMS) ensures optimal voltage for starting in all weather conditions; and fixed over running clutch with 50 percent less moving mass protects internal components in case of "blind start" or "click no crank."

www.boschusa.com
Bosch



TRANSMISSION PAN

For high performance Nissan 350Z and Infiniti G35 and QX56, PML offers a heavy duty, high quality transmission pan for increased strength and cooling. This heavy-duty transmission oil pan features a low profile for ground clearance; finned aluminum construction for additional cooling; extra oil capacity for greater lubrication reserves; a drain plug for easier maintenance; and thicker walls and flange surfaces to add strength to the transmission housing and provide for a leak-proof seal. The company states this pan is a simple bolt-on replacement for the stock pan for quick and easy installation. This PML pan answers the transmission care needs of demanding Nissan and Infiniti owners and drivers.

www.yourcovers.com
PML



PULSE PLUG

The Pulstar gg1 Pulse Plug for the Chrysler 3.6L engine has shown an increase of six horsepower (HP) over stock plugs in dyno testing conducted by Enerpulse Inc. In addition, the testing demonstrated a fuel economy increase of 4.26 percent. The Pulstar gg1 pulse plug fits the V6 engine applications for the Dodge Challenger, Charger, Durango and Avenger RT, and the Chrysler 300. Pulstar Pulse Plugs look like a spark plug on the outside, but a unique capacitor-based circuit inside captures energy normally wasted by spark plugs and generates a spark with 20,000 times greater energy, the manufacturer says.

www.pulstar.com
Enerpulse/Pulstar



BATTERY CHARGER

The MUS 3300 from CTEK is the perfect battery charger for households with multiple vehicle types. CTEK's unique battery charging system allows owners to outfit all of their 12-volt equipment with an easy access charging port that makes connecting to the charger fast and safe, the company says. From cars to lawn mowers to snowmobiles, the MUS 3300 can monitor and maintain all common battery types including AGM batteries. Using the mode button, consumers can conveniently select the type of battery and walk away because the CTEK MUS 3300 charger will handle the rest. With its built-in short-circuit protection, the CTEK MUS 3300 takes the intimidation out of proper battery maintenance. All CTEK chargers are designed to be connected to the battery while still in the vehicle, without fear of damaging sensitive vehicle electronics.

www.smartercharger.com
CTEK Power



PERFORMANCE EXHAUST SYSTEM

CORSA Performance Exhausts has released a new cat-back performance exhaust system for the 6.4L, V-8 2013 Jeep Grand Cherokee SRT-8. The system features the company's patented Reflective Sound Cancellation Technology. The CORSA Jeep Grand Cherokee SRT-8 exhaust's straight-through 2.75-inch, nonrestrictive system design maximizes airflow by removing the OEM valves, which improves performance and fuel economy, according to the company. Designed with mandrel bends, the system delivers increased airflow and maximizes horsepower with a 28 hp gain, without tune, over stock exhaust systems. All components, including clamps and hangers, are constructed of premium grade, 304L stainless steel to ensure the product's appearance won't diminish over the life of the vehicle.

www.corsaperformance.com
CORSA Performance



RADIATOR COOLANT TEST STRIP KITS

Spectra Premium Industries introduces its Radiator Coolant Test Strip kits. This retail-oriented display includes 24 individually packaged test strips to allow consumers to easily and accurately test their vehicle's coolant pH level. This compact retail solution provides a quick and simple method to prevent coolant contamination, while also promoting impulse buys and upselling coolant sales, the company says. Compatible with all types of coolant, these test strips provides fast and accurate results in seconds.

www.spectrapremium.com
Spectra Premium



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Hunter's QuickComp™ lathe improves on previous designs with a faster and easier setup. A two-way adjustable compensation adaptor works with Hunter's patented ProComp® computerized compensation to adjust for lateral runout of the hub in seconds. This feature allows rotors to be refinished within OEM specifications in a matter of minutes.



Hunter Engineering

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Magneti Marelli

TEXTAR BRAKE ROTORS

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



WORLDPAAC

DENSO CABIN AIR FILTERS

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



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TPMS SENSORS MADE TO FIT, PERFORM

Standard® TPMS sensors are engineered to match OE fit, form and function, plus they can be ID cloned to the sensor they replace using a TechSmart cloning tool. Each clone-able sensor has a unique sensor ID, the right protocol and matching body style. Technicians can bypass complex factory relearn processes, saving time and money.



Standard Motor Products

FEDERATED OFFERS PREMIUM BRAKING PERFORMANCE FOR TODAY'S VEHICLES

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



Federated Auto Parts

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Advance Auto Parts Professional

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NEW TECHNOLOGY SOLUTIONS

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



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These days, car batteries need more than starting power, and the NAPA Legend Premium AGM takes power to a whole new level. Whether it's taking charge of power-hungry electronics, stop-and-go traffic, or brutal weather, the NAPA Legend Premium AGM gives you twice the endurance of conventional designs. So insist on the battery with the power of KNOW HOW. Visit your local NAPA AUTO PARTS Store today. NAPAonline.com



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Gabriel

DENSO WIPER BLADES

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



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AD INDEX

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OUT OF SIGHT, OUT OF MIND

YOU MAKE A HABIT OF CHECKING THE ENGINE'S AIR FILTER, BUT WHEN WAS THE LAST TIME YOU CHECKED THE CABIN'S?

BY **PETE MEIER**

Technical Editor

Next time you're driving to work, take a moment to observe the vehicles around you. How many do you see that have every window rolled up tight in an effort to keep that nice air conditioned air inside (or to keep all that winter chill outside, depending on the time of year)? And cars made in the last 15 years or so seal so well that you almost can feel the pressure change as you close the last door.

I think you'll come up with the same observation I have. Most drivers like their cars sealed tight. There is one problem with that: contaminated air.

Did you know that unfiltered cabin air could be nearly six times more polluted than the air outside the car? By pollutants, I mean pollen, dust, mold spores, diesel soot and smog. But that's not a problem for about 85 percent of the cars made since 2006, because they are equipped with a cabin air filter to clean up the incoming air.

First introduced in Europe in 1987 in an effort to protect passengers from pollen and dust, they quickly evolved to include traffic-related emissions like diesel soot and smog. But the idea really didn't catch on in the United States until the mid-1990s, and even then it was used primarily on higher-end OEM offerings.

Cabin air filters have come a long way in a relatively short time. Most filters are



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able to filter out particles as small as 3 microns, with top-of-the-line filters able to screen out contaminants as small as 0.001 micron. (A dot made with a sharp pencil is about 200 microns in size.)

Cabin air filters, as a side benefit, help keep the A/C evaporator clean, which reduces the potential for mildew and odor as well as ensures peak cooling performance. A clogged cabin filter can impact A/C performance (by choking off air flow to the evap) and in some cases, has resulted in A/C compressor damage.

We understand the need to keep the engine's filters clean and maintained. When was the last time you checked to see if your customer's car was equipped with a filter for the air they're breathing and inspected its condition?

Cabin filters are as much a part of routine maintenance as servicing any other filter on the car. And that's the topic of this month's edition of The Trainer. **ZZ**

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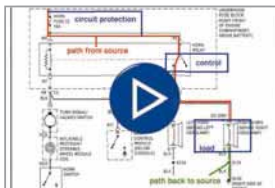


[VIDEOS]



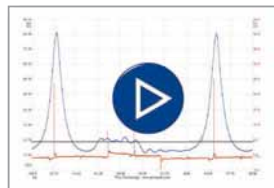
Quieting a case of the 'moans'

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Do cat codes equal cat failure?

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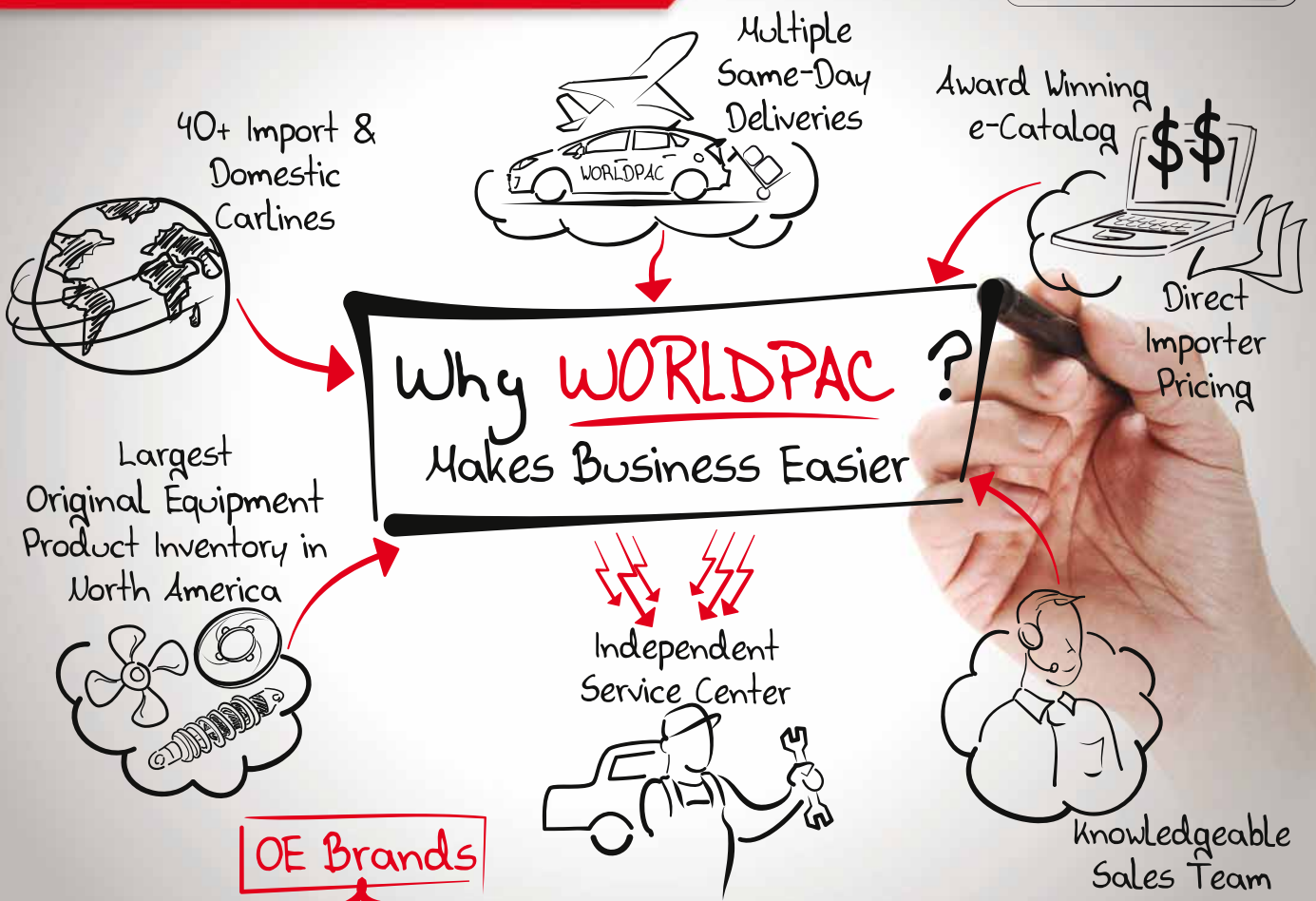


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What's behind door repair for the 2008 Sportage

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Although we don't mind beating our own drum when it comes to the quality of Kia automobiles, it is even better when someone else does it for us. The recognized leader when it comes to judging the quality of cars is unequivocally J.D. Power & Associates. And guess what they have to say? Well, when it comes to initial quality, Kia now ranks in the Top 10. This is the first time that has happened and was spurred by two Kia vehicles as leaders in their respective segments: the Kia Soul led the Compact Multi-Purpose vehicles, while the Kia Sportage led the Sub-Compact CUV segment.

Clearly, this ranking and the leadership positions of these two vehicles



When it comes to initial quality, Kia now ranks in the Top 10.

is no fluke. Commitment to quality has been Kia's mantra for some time and will continue to be its mantra.

After J.D. Power announced the results of its Initial Quality Study, Byung Mo Ahn, group president and CEO, Kia Motors America and Kia Motors Manufacturing Georgia, said, "Achieving Top-10 status within the industry reflects just how far the Kia brand has come in improving the ownership experience and vehicle quality for our customers and advancing value to new levels of sophistication across our entire model line."

Of course, this can only happen if two things take place: 1) the manufacturing process is beyond reproach and 2) the individual parts that make up every Kia vehicle are world-class.

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Kia Motors America, Inc.

In This Issue

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Free Wheelin'

The hub is the center of smooth and effortless travel



Open Door Quality

What's behind door repair for the 2008 Sportage



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Free Wheelin'

The hub is the center of smooth and effortless travel

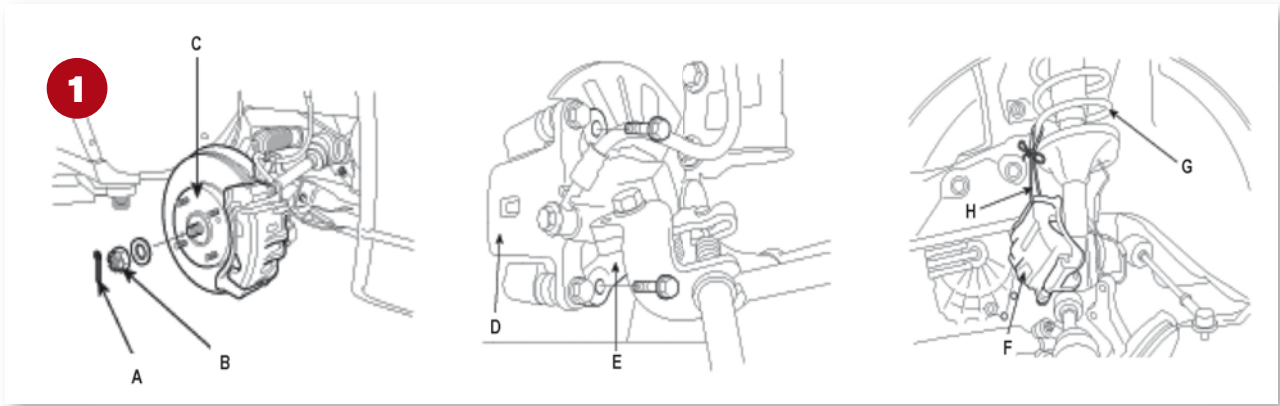
THERE ARE MANY PIECES AND PARTS to a wheel hub assembly. When properly installed and torqued to the correct specifications motorists can expect care-free driving. Special tools and special care in the disassembly and reassembly are required to assure wheel rotation is smooth and unencumbered.

MODEL FEATURED:
2006 Spectra



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» **WARNING:** Vehicle servicing performed by untrained persons could result in injury to those persons, to others, or to the vehicle.



Removal

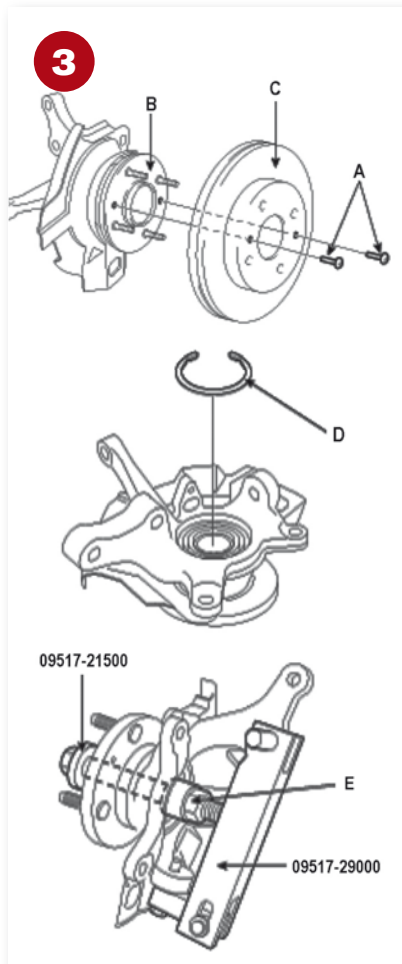
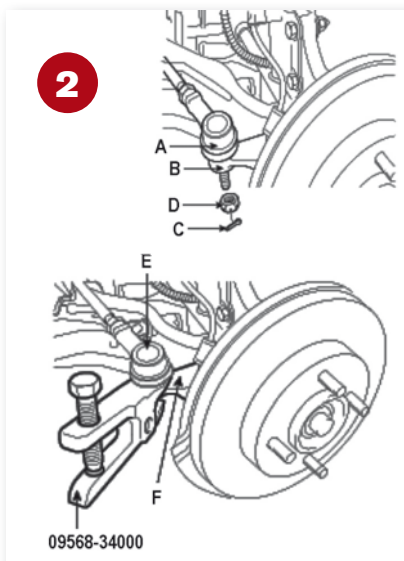
1 Remove the front wheel and tire. While applying the brakes, remove the split pin (1A), then remove the locknut (1B) and washer from the front hub (1C). Remove the caliper (1D) from the knuckle (1E) and hang the caliper (1F) on the front damper (1G) with wire (1H). Remove the wheel speed sensor from the knuckle.

2 Disconnect the tie rod end ball joint (2A) from the knuckle (2B) using the special tool (09568-34000).

Note: Be sure to secure the ball joint, remove tool to the vehicle so that it doesn't fall when the ball joint is removed.

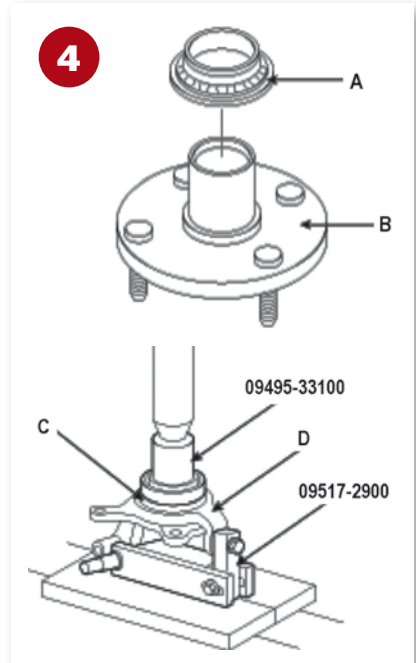
Remove the split pin (2C). Remove the lock nut (2D). Disconnect the ball joint (2E) from knuckle (2F) using the special tool (09568-34000). Disconnect the strut assembly from the knuckle. Disconnect the lower arm ball joint from the knuckle using the special tool.

Caution: Be careful not to damage the boot and tone wheel.



Disassembly

3 After removing the fixed screws (4A) mounting the brake disc (4C), remove the brake disc (4C) from the hub (4B). Remove the snap ring (4D). Install the special tools (09517-29000, 09517-21500) as shown in figure 4. Separate the hub from the knuckle by turning nut (4E) of the special tool (09517-21500). Using a plastic hammer, remove the dust cover from the knuckle.

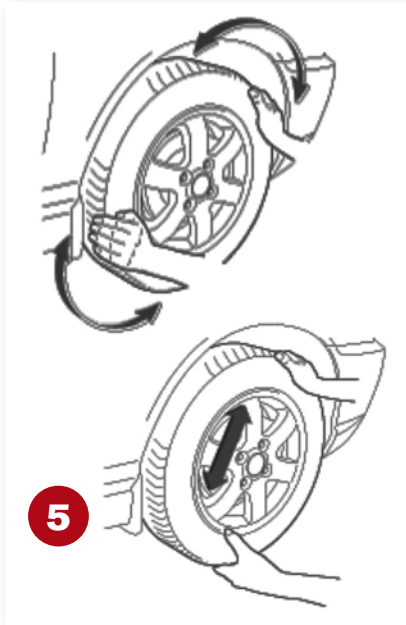


4 Remove the bearing inner race (5A) from the hub (5B) using the special tool (09495-33000). Using the special tools (09495-33100, 09517-29000), remove the wheel bearing outer race (5C) from the knuckle (5D).

Inspection

Wheel Bearing Check

5 Raise the vehicle until the front tires are off the floor. Make sure the wheels are in a straight forward position. *Note: Make sure the wheel rotates freely and that the brake pads are retracted sufficiently to allow free movement of the tire and wheel assembly. Spin the tire by hand to check the wheel bearings for roughness.* Grip each front tire at the top and bottom and move the wheel inward and outward while lifting the weight of the tire off the



front wheel bearings. If the tire and wheel (hub) is loose on the spindle, does not rotate freely, or has a rough feeling when spun, carry out one of the following. On vehicles with inner and outer bearings, inspect the bearings and races for wear or damage. Adjust or install new bearing and races as necessary. Check the hub for cracks and the splines for wear. Check the brake disc for scoring and damage. Check the knuckle for cracks. Check the bearing for cracks or damage.

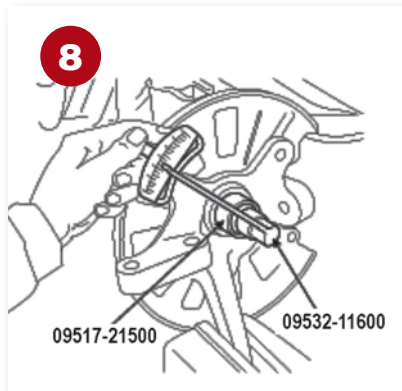
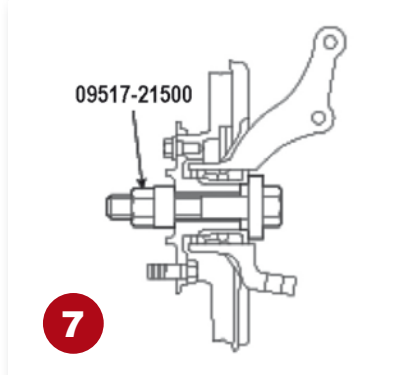
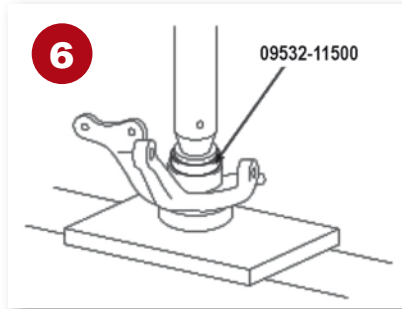
Reassembly

6 Apply multi-purpose grease to the contacting surface of the knuckle hub and bearing thinly. Using the Special Tool (09532-11500), press-in the bearing to the knuckle. Install the snap ring.

Note: Press-in the outer race of the wheel bearing to prevent damage to the bearing assembly. When installing a bearing assembly, always use a new one. The right and the left bearings must be replaced as a matched set.

Using a plastic hammer, install the dust cover. Press-in the hub to the knuckle.

Note: Press-in the inner race of the wheel bearing to prevent damage to the bearing assembly.



7 Tighten the hub and the knuckle to the specified torque using the Special Tool (09517-21500).

Specified torque Nm (kg-cm, lb-ft)
200~250 (2000~2500, 147~184)

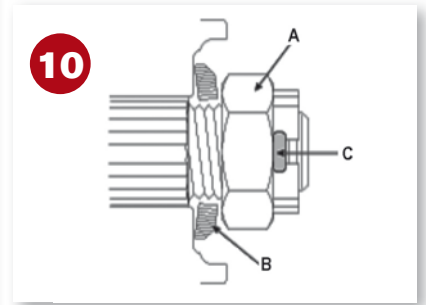
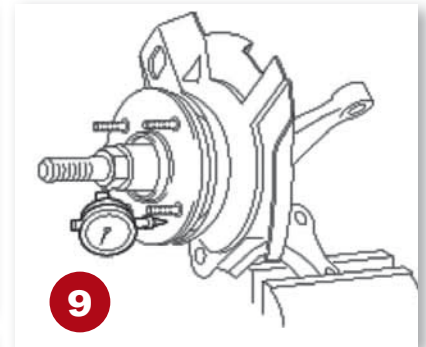
8 Measure the hub bearing starting torque.

Hub bearing starting torque [Limit]
1.8 Nm (18 kg-cm, 1.3 lb-ft) or less

If the starting torque is 0 Nm (0 kg-cm, 0 lb-ft), measure the hub bearing axial play.

9 If the hub axial play exceeds the limit while the nut is tightened to 200~260 Nm (2000~2600kg-cm,

145~188 lb-ft), the bearing, hub and knuckle are not installed correctly. Repeat the disassembly and assembly procedure.



Hub bearing axial play [Limit]
0.008 mm (0.0003 in.) or less

Remove the Special Tool. Fix the brake disc with the mounting screws.

Installation

10 Installation is the reverse of the removal procedures.

Note: Tighten the components below to the specified torque as follows :

Items	Torque Nm (kg-cm, lb-ft)
Drive shaft lock nut	200~250 (2000~2500, 147~184)
Lower arm ball joint to knuckle nut	60~72 (600~720, 43~52)
Knuckle to strut assembly nut	130~150 (1300~1500, 94~108)

Install the strut assembly and the drive shaft in the knuckle. Tighten the lower arm ball joint nut. Connect the wheel speed sensor. Install the caliper assembly in the hub and knuckle assembly which the brake disc is already installed. Tighten the tie rod end ball joint nut and insert the split pin. Insert the washer (3B) and tighten the lock nut (3A). Insert the split pin (3C). Install the wheel and tire and tighten the wheel nuts. **KIA**

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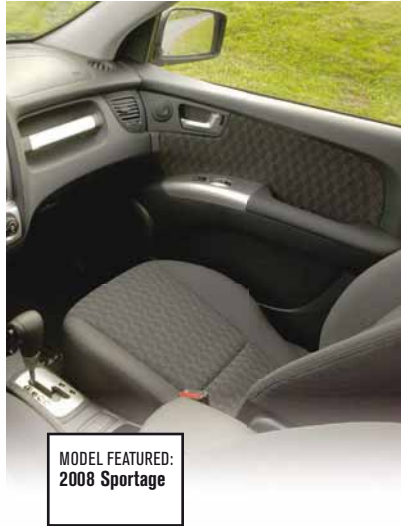
Genuine Parts

Open Door Quality

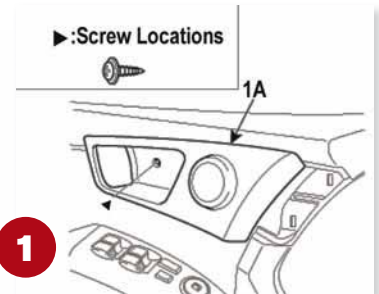
What's behind door repair for the 2008 Sportage

The first measure of quality, as seen by vehicle owners, is how well a vehicle looks and how well it is assembled. When it comes to doors, they expect the glass to roll up and down effortlessly, locks that “pop” and handles that work firmly and smoothly. And then there is that expected “thump” when shutting the door.

So, to keep everything looking and working right in and on the 2008 Sportage door, one just needs to follow the proper, sequential steps. Every internal and external mechanical/electrical repair component – from door trim replacement to door adjustment - is addressed here.



MODEL FEATURED:
2008 Sportage



1

Door trim replacement

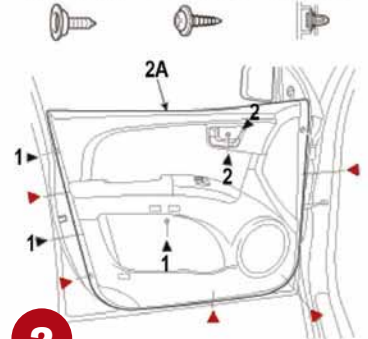
1 Remove the quadrant inner cover.
Remove the inside handle cover (1A).

2 Loosen the door trim (2A) mounting screws. Disconnect the power window switch connector, power mirror connector, and door courtesy lamp connector. Remove the door trim seal. Installation is the reverse of removal.

Note: Take care not to scratch the door trim and other parts. Put on gloves to protect your hands. Roll the glass up and down to see if it moves freely without binding. Make sure the door locks and opens properly.

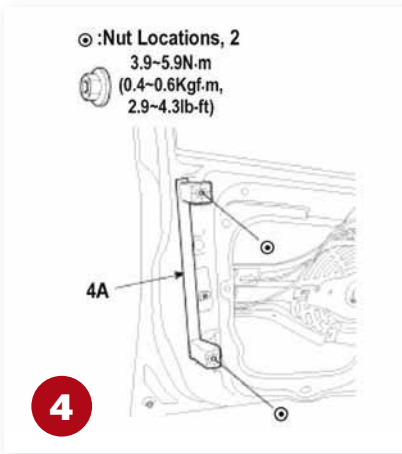
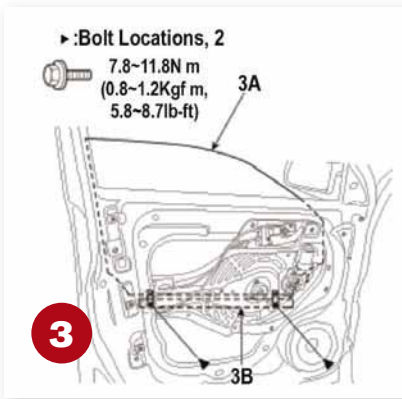
Fastener Locations

1▶:Screw, 4 2▶:Screw, 1 ▶:Clip, 5



2

» WARNING: Vehicle servicing performed by untrained persons could result in injury to those persons, to others, or to the vehicle.



Glass replacement

3 Remove the front door trim. Carefully move the glass (3A) until you can see the bolts, then loosen them. Separate the glass from the glass run and carefully pull the glass out through the window slot (3B).

Caution: Take care not to drop the glass or scratch the glass surface.

Installation is the reverse of removal.

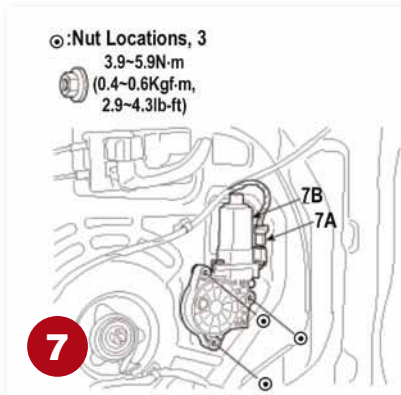
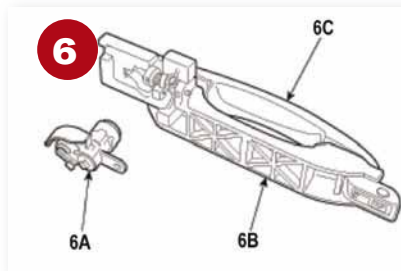
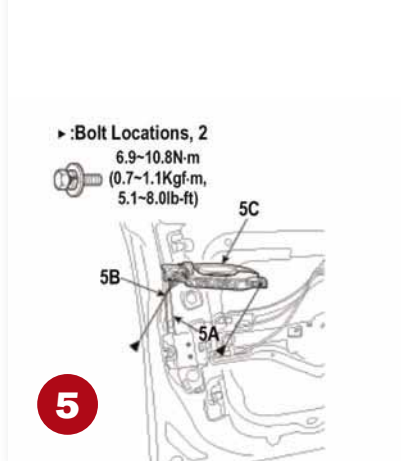
Note: Make sure the door locks and opens properly. Adjust the position of the glass as necessary.

Rear channel replacement

4 Remove the front door trim. Remove the glass. After disconnecting the glass molding, remove the rear channel (4A). Installation is the reverse of removal.

Outside handle replacement

5 Remove the following items: Door trim, glass, rear channel. Disconnect the outside handle rod (5A) and lock rod (5B). After removing the outside handle-mounting bolt, remove the outside handle base (5C) and key cylinder.



6 After removing key cylinder (6A) and outside handle base (6B), remove the outside handle lever (6C). Installation is the reverse of removal.

Note: Roll the glass up and down to see if it moves freely without binding. Make sure the door locks and opens properly.

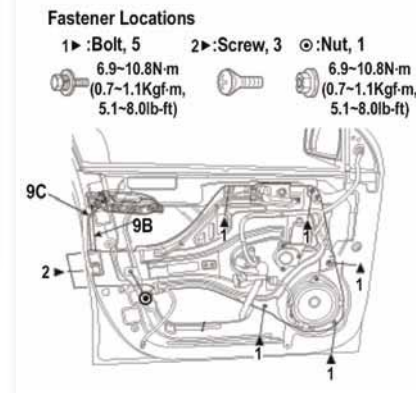
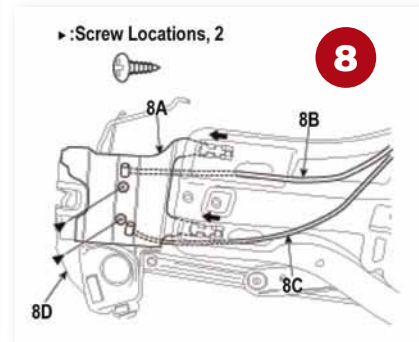
Power window motor replacement

7 Remove the front door trim. After disconnecting the connector (7A), remove the power window motor (7B). Installation is the reverse of removal.

Note: Roll the glass up and down to see if it moves freely without binding. Make sure the door locks and opens properly.

Latch assembly replacement

8 Remove the front door trim. Remove the glass. Remove the door module (8A). Lock cable (8B), inside handle cable (8C) then remove the latch



assembly (8D). Installation is the reverse of removal.

Note: Roll the glass up and down to see if it moves freely without binding.

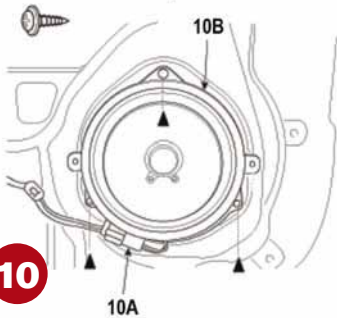
Door module replacement

9 Remove the front door trim. Remove the glass. Disconnect the wiring harness (9A). Disconnect the lock rod (9B) and outside handle rod (9C). Installation is the reverse of removal.

Note: Roll the glass up and down to see if it moves freely without binding. Make sure the door locks and opens properly.

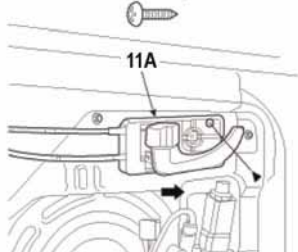
► This and other technical information is available at www.kiatechinfo.com.

►: Screw Locations, 3

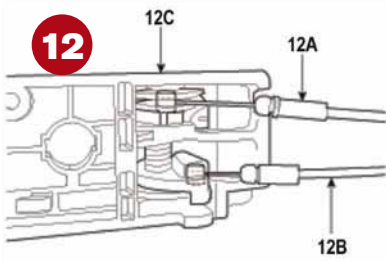


10

►: Screw Locations, 1

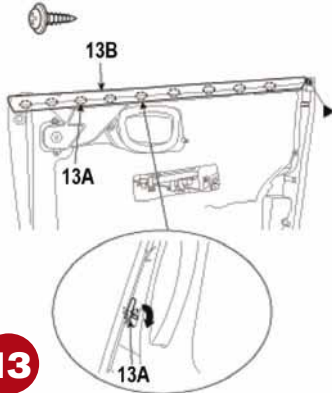


11



12

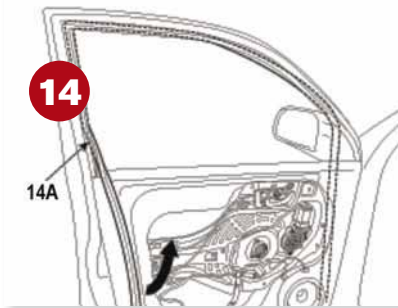
►: Screw Locations, 1



13

Speaker replacement

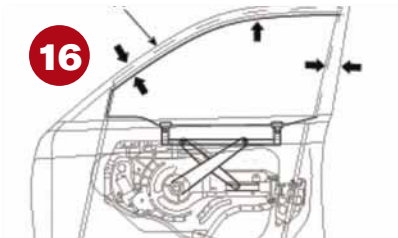
10 Remove the front door trim. Disconnect the speaker connector (10A), and remove the speaker (10B). Installation is the reverse of removal.



14



15



16

Inside handle replacement

11 Remove the front door trim. Loosen the inside handle (11A) mounting screw. Push the inside handle forward to disconnect from the door module.

12 Disconnect the lock cable (12A) and inside handle connect cable (12B). Remove the inside handle (12C). Installation is the reverse of removal.

Note: Make sure the door locks and opens properly.

Door belt weatherstrip replacement

13 Remove the front door trim. Release the hooks (13A), and then remove the door belt weather strip (13B). Installation is the reverse of removal.

Glass run replacement

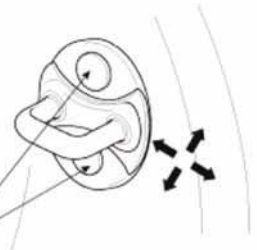
14 Remove the front door trim. Remove the glass. Remove the glass run (14A) from the lower part. Installation is the reverse of removal.

Door weather strip replacement

15 Release the clips then remove the door weather strip (15A). Installation is the reverse of removal.

Door striker adjustment

1.7-2.2 kgf-m

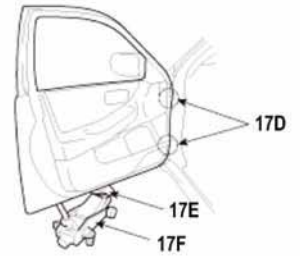


12.7-25.5N-m
(1.3-2.6Kg-f-m,
9.4-18.8lb-ft)

33.3-41.2N-m
(3.4-4.2Kg-f-m,
24.6-30.4lb-ft)

17C

17B



17

Glass adjustment

16 Remove the following parts: Quadrant cover and door trim. Check that the glass moves smoothly. *Note: Check the glass run channel for damage or deterioration, and replace them if necessary.*

Door position adjustment

17 Place the vehicle on a firm, level surface when adjusting the doors. Adjust at the hinges (17A): Loosen the door mounting bolts (17B) slightly, and move the door IN or OUT until it aligns flush with the body. Loosen the hinge mounting bolts (17D) slightly, and move the door BACKWARD or FORWARD, UP or DOWN as necessary to equalize the gaps. Place a shop towel (17E) on the jack (17F) to prevent damage to the door when adjusting the door.

Check that the door and body edges are parallel. Grease the pivot portions of the hinges indicated by the arrows. Check for water leaks.

Note: After installing the door, check for a flush fit with the body, then check for equal gaps between the front, rear, and bottom, door edges and the body. Check that the door and body edges are parallel. Before adjusting, replace the mounting bolts. (KIA)

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