MOTOR AGE

NOV/DEC 2022
VOL. 141, NO. 10
VEHICLESERVICEPROS.COM
ENDEAVOR BUSINESS MEDIA

LEVEL UP

You need to manage your diagnostics workflow from start to finish. So you need the most advanced information-driven scan and scope device in the industry, with the storage, processing and communications capabilities to get you through every step—designed and built specifically for the automotive industry by a company you're absolutely sure you can trust.

Driven by Fast-Track® Intelligent Diagnostics, the **ZEUS+™** provides you with the information you need to diagnose, repair and manage that issue—simplifying your workflow and increasing your efficiency on every job.

It's the only tool on the market that can do that.
All to help you level up your game.

snapon.com/zeusplus

Fast-Track® Intelligent Diagnostics.
Available on the APOLLO,™ TRITON™ and ZEUS.™

GET TO KNOW THE NEW ZEUS+™

Scan here to see it in action

Snap-on®

Smarter. Faster. Fixed.

MOTOR AGE

NOV/DEC 2022
VOL. 141, NO. 10
VEHICLESERVICEPROS.COM

ENDEAVOR BUSINESS MEDIA

CARTER FUEL SYSTEMS

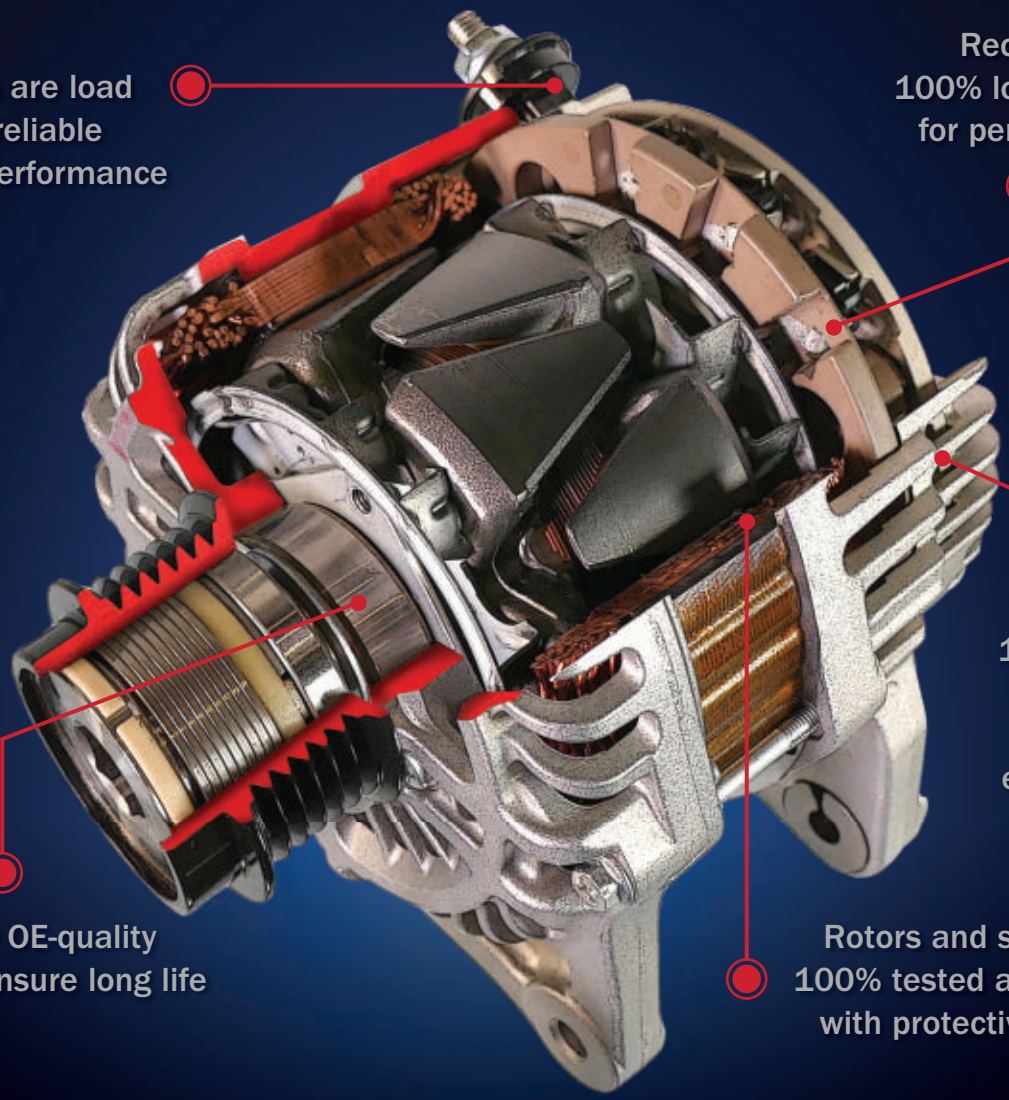
DIRTY JOBS:

TAKING ON FUEL SYSTEM CONTAMINATION

Removing a weed from a garden means little if you don't get to the root. The same holds true with replacement of failed fuel pumps.

FIND THE **DIAGNOSTIC PROCESS SUPPLEMENT** INCLUDED AFTER THE REGULAR ISSUE

PREMIUM ALTERNATORS



YOU DON'T CUT CORNERS. NEITHER DO OUR PRO PARTS.

Get OE performance and industry-leading coverage with Carquest Premium Alternators. Learn more about our professional parts at my.advancepro.com/alternator.

CARQUEST AUTO PARTS | AUTOPART INTERNATIONAL | WORLDPAC | Advance Professional

MOTOR AGE

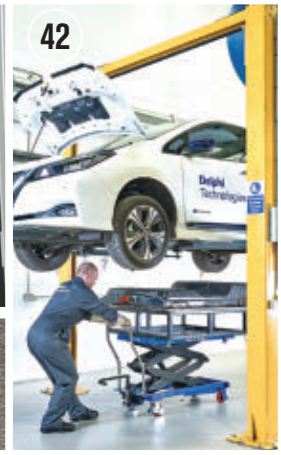
Talk Shop Anytime

NOV/DEC 2022

VOL. 141, NO. 10 //

VEHICLESERVICEPROS.COM

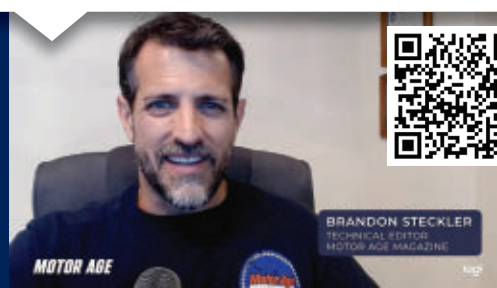
OPERATIONS



TECHNICAL

IN EVERY ISSUE

WEB EXCLUSIVES



VIDEO: MASTERING VEHICLE DIAGNOSIS WITH BRANDON STECKLER: PART 1

Capturing the correct diagnostic data is what we are always after, but capturing the data correctly is imperative to an efficient and accurate diagnosis. Learn from a master diagnostician - Motor Age Technical Editor Brandon Steckler!

MOTOR AGE

VEHICLESERVICEPROS.COM

Endeavor Business Media, LLC
1233 Janesville Avenue, Fort Atkinson, WI 53538. Phone: 920-563-6388

EDITORIAL STAFF

JAY SICHT
MANAGING EDITOR
jsicht@endeavorb2b.com

PETE MEIER ASE
CREATIVE DIRECTOR, TECHNICAL
pmeier@endeavorb2b.com

BRANDON STECKLER
TECHNICAL EDITOR
bhsteckler@gmail.com

RHONDA COUSIN
ART DIRECTOR

CONTRIBUTORS

NEIL FRYER
DAVE HOBBS
BRIAN HUNNICUTT
CHRIS MARTINO
KEVIN MCCARTNEY
DUANE "DOC" WATSON

PRINTED IN U.S.A.

SUBMISSIONS:
Motor Age welcomes unsolicited articles manuscripts, photographs, illustrations and other materials but cannot be held responsible for their safekeeping or return.

Connectiv
The Business Information Association, a division of SIIA

MEMBER OF:

ENDEAVOR BUSINESS MEDIA

CEO – **CHRIS FERRELL**
CRO/CMO – **JUNE GRIFFIN**
COO – **PATRICK RAINS**
CHIEF ADMINISTRATIVE AND LEGAL OFFICER – **TRACY KANE**
EVP, TRANSPORTATION – **REGGIE LAWRENCE**
VP, TECHNOLOGY – **GLENN SCHEITHAUER**
VP, ACCOUNTING – **ANGELA MITCHELL**
VP, FINANCE – **JESSICA KLUG**
VP, DIGITAL BUSINESS DEVELOPMENT – **MONIQUE LEIJA**
VP, PRODUCTION OPERATIONS – **CURT PORDES**

BUSINESS STAFF

KYLIE HIRKO
VP/GROUP PUBLISHER
MICHAEL WILLINS
BUSINESS DEVELOPMENT DIRECTOR, MOTOR AGE TRAINING
LESLIE BROWN
CUSTOMER MARKETING MANAGER
SHEILA WARD
PRODUCTION MANAGER
MELISSA MENG
AD SERVICES MANAGER
TRACY SKALLMAN
AUDIENCE DEVELOPMENT MANAGER
JILLENE WILLIAMS
SALES COORDINATOR

SALES STAFF

LISA MEND
lmend@endeavorb2b.com
MICHAEL PARRA
mparra@endeavorb2b.com
CORTNI JONES
cjones@endeavorb2b.com
DIANE BRADEN
dbraden@endeavorb2b.com
MATTIE GORMAN
mgorman@endeavorb2b.com
JAMES HWANG
Inside Sales & Brand Manager, ASE Study Guides
jhwang@endeavorb2b.com

REPRINT SERVICES
reprints@endeavorb2b.com

CUSTOMER SERVICE
Subscription Customer Service
MotorAge@omeda.com
(877)-382-9187

Motor Age (USPS 925560) (Print ISSN: 1520-9385, Digital ISSN: 1558-2892) is published 10 times per year, by Endeavor Business Media, LLC, 1233 Janesville Avenue, Fort Atkinson, WI 53538. Periodicals postage paid at Fort Atkinson, WI 53538 and additional mailing offices. Subscription prices: U.S. one year, $77; U.S. two year, $136; one year Canada, $117; two year Canada, $215; one year international, $117; two year international, $215. POSTMASTER: Send address changes to Motor Age, P.O. Box 3257, Northbrook, IL 60065-3257. Please address subscription mail to Motor Age, P.O. Box 3257, Northbrook, IL 60065-3257. Canadian G.T.S. number: R-124213133RT001.

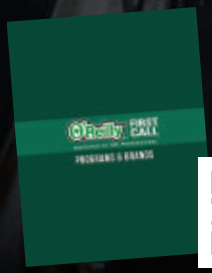
O'Reilly FIRST CALL®

DEDICATED TO THE PROFESSIONAL

THE

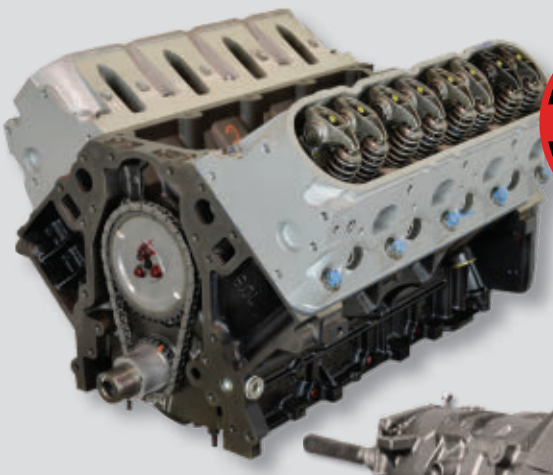
POWER TORQUE® ADVANTAGE

Let Us Be Your Parts & Equipment Supplier



Scan QR code to view catalog, or visit
www.firstcallonlinecatalogs.com

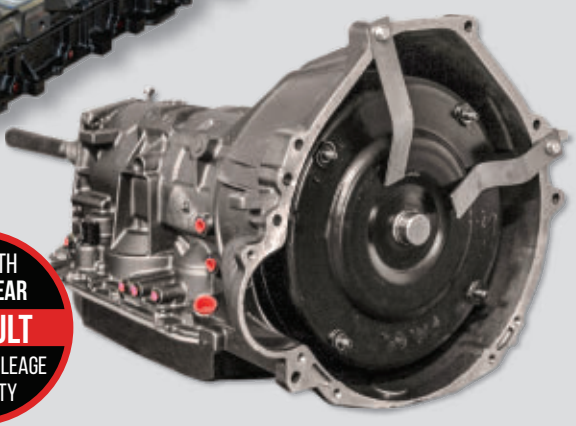
POWER TORQUE® ENGINES



NOW WITH FOUR-YEAR NO-FAULT UNLIMITED MILEAGE WARRANTY

ENGINES

- Built with OE-quality replacement parts and expert workmanship
- Remanufactured engines are fully disassembled; heads, blocks, cranks and cams are machined, and worn parts are replaced
- Each engine is individually tested after assembly to assure compression, oil pressure, and water jacket integrity
- ISO 14000 and ISO 9001 quality certification



NOW WITH THREE-YEAR NO-FAULT UNLIMITED MILEAGE WARRANTY

TRANSMISSIONS

- Complete road simulation testing using application-specific dynamometer testing program
- Complete system correction and recalibration kit installed to address OE problems with upgrades exceeding OE requirements to eliminate the possibilities of front seal leaks, premature bushing wear, and vibration
- Fully remanufactured and improved torque converter, matched to unit and tested

AVAILABLE EXCLUSIVELY AT

O'Reilly FIRST CALL®

DEDICATED TO THE PROFESSIONAL

FIRST CALL ONLINE MAKING IT FASTER AND EASIER THAN EVER TO ORDER PARTS

FIRSTCALLONLINE.COM

Visit our website for a complete, internet-based catalog designed exclusively for the Professional.

ADV 1789

WORKFORCE

TECHNICIAN SHORTAGE STILL A SERIOUS CHALLENGE, TECHFORCE REPORTS

The TechForce Foundation released its 2022 Transportation Technician Supply & Demand Report.

The report revealed that the supply of incoming automotive technicians from post-secondary programs dropped 11.8 percent last year.

Additionally, the supply of program graduates slipped 2.6 percent and 0.4 percent, respectively, in the diesel and collision repair segments but has fallen by a combined 17 percent over the past five years.

According to a press release, TechForce estimates demand for new entrant automotive/diesel/collision repair technicians - for new positions, replacements for occupational separations, and unfilled positions from prior years - will reach 232,000 in 2022 and total well over 900,000 through 2026.

"This year's report underscores not only the challenges we face in attracting, training, and retaining technicians but also the boundless opportunities for talented young people to build successful, rewarding careers in one of the world's most dynamic and technology-intensive industries," said TechForce Foundation CEO Jennifer Maher in the press release. "The solution to this crisis lies in industry, nonprofit, education and government partners working together to build awareness, curiosity and interest in these careers among our youth."

"THE SOLUTION TO THIS CRISIS LIES IN INDUSTRY, NONPROFIT, EDUCATION AND GOVERNMENT PARTNERS WORKING TOGETHER TO BUILD AWARENESS, CURIOSITY AND INTEREST IN THESE CAREERS AMONG OUR YOUTH."

To view the full report, go to techforce.org/supply-demand-report/.

2023 CONFERENCE

TRAINING AND NETWORKING

MECHANIC ALLIANCE TO HOLD ITS FIRST TRAINING & DEVELOPMENT CONFERENCE NEXT YEAR AT SOUTHERN ILLINOIS UNIVERSITY

Mechanic Alliance will hold its first Training & Development Conference at the Southern Illinois University Automotive Center in Murphysboro, Ill., on Aug. 10-12, 2023. Southern Illinois University is one of the few Baccalaureate Universities left in America.

More information is forthcoming, but for now, classes planned include:

- ADAS
- EV training
- Circuit testing
- Diagnostics and advanced testing
- Diesel training
- 5-gas analyzer
- Heavy duty diagnostic training
- Mastermind meetings
- Owners roundtable
- Owners shop problems
- Talent acquisition

Sponsors include Topdon, Dyvo, Master Automotive Training, Noregon Vehicle Data Experts, and the SIU Department of Automotive Technology.

For more information, go to mechanicalliance.com.

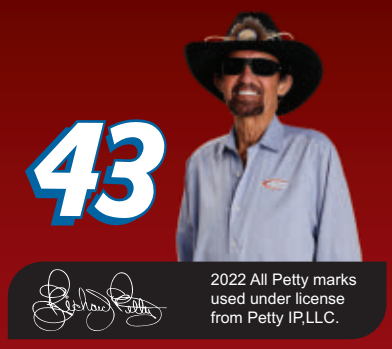
THINKCAR

FINISH FASTER WITH THE BEST TECH!

TOOLS TO KEEP YOU ON TRACK & IN THE RACE

ALL IN ONE TOOL!

- **Car & HD coverage**
- **Key programming**
- **ADAS support**
- **Online programming**



See your local tool dealer or distributor to test drive a Platinum series!


PLATINUM S6


PLATINUM HD


PLATINUM S20


PLATINUM S10 PRO

THINKCAR Tech, Inc.
US Tech Support Ph: 833-692-2766 | Business Hours Mon - Fri 8am - 5pm PST

RECALLS

NHTSA ISSUES CONSUMER ALERT FOR EXPLODING TAKATA AIR BAGS

Still one of the largest, if not largest, recall in automotive history, millions of vehicles with Takata air bags remain a serious threat to safety.

The National Highway Traffic Safety Administration (NHTSA) is warning ALL vehicle owners to immediately check to see if their vehicle has an open Takata air bag recall.

If it does, owners need to contact their dealership to schedule a free repair as soon as possible and follow any warnings from the vehicle manufacturer, according to a press release from NHTSA.

How to Check for Recalls

- Use NHTSA's Recalls Lookup Tool to check your Vehicle Identification Number (VIN) for any open safety recalls, including the urgent Takata recall.
- Download NHTSA's SaferCar app and let it check automatically for you.
- If your vehicle does have a safety recall, call your automaker's local dealer to schedule the free recall repair.
- Sign up at NHTSA.gov/Alerts to be notified by email if your vehicle is affected by a future recall.

NHTSA issued this urgent warning after one person was killed after a crash in a 2006 Ford Ranger where the Takata driver's side air bag inflator ruptured. The vehicle was already under a "do not drive" warning.

Additionally, NHTSA is aware of other suspected inflator ruptures in vehicles from other automakers potentially due to exploding Takata air bags.

Even minor crashes can result in exploding air bags that can kill or produce life-altering injuries. Older model year vehicles put their occupants at higher risk, as the age of the air bag is one of the contributing factors, the press release stated.

For Takata-specific information from vehicle manufacturers, go to nhtsa.gov/takata-recall-spotlight/takata-contact-information.

RECOGNITION

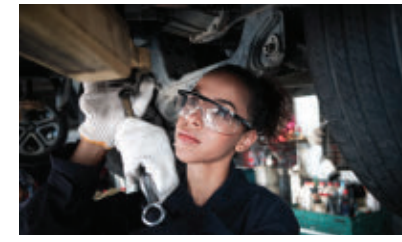
2022 WOMEN OF THE YEAR ANNOUNCED

At this year's AAPEX show in Las Vegas, Nev., Women in Auto Care announced its 2022 Women of the Year award winners during the Women in Auto Care Awards ceremony. The Women of the Year awards include the "Auto Care Woman of the Year", "Auto Care Woman of Excellence", "Female Shop Owner of the Year" and new this year, "Female Shop Employee of the Year" and "Women in Auto Care Champion of the Year."

"Each year since the inception of the Women in Auto Care awards, our group of nominations grows exponentially," Jessica Toliuszis, Chair, Women in Auto Care. "This year, we saw the largest group of finalists Women in Auto Care has ever received. Our judges had the nearly impossible task of awarding only one woman in each category. Adding new accolades, like a shop team member and champion, expands our impact and our ability to celebrate the incredible talent in the automotive aftermarket."

The recipients of the 2022 Women of the Year Awards are as follows:

- **Auto Care Woman of the Year:** Kim Nolan, senior vice president, traditional market, BBB Industries
- **Auto Care Woman of Excellence:** Kathleen Long, chief revenue officer, RepairPal
- **Female Shop Owner of the Year:** Kristi Hudson, co-owner, Troy Auto Care II
- **Female Shop Employee of the Year:** Megan Dineff, manager, Ervine's Auto Repair & Grand Rapids Hybrid and EV
- **Women in Auto Care Champion of the Year:** Tanya Hunt, commercial project manager, BBB Industries



"These women distinguished themselves through their integrity, unselfish commitment, and high level of performance within our industry," Toliuszis notes. "I want to especially acknowledge Rhonda Young from Kukui who sits on our executive committee as our award chair. Behind the scenes, Rhonda works tirelessly to coordinate nominations, applications, interviews, and judging panels. None of this is possible without Rhonda's commitment to elevating our Women in Auto Care community."

For more information on the winners, go to autocare.org.

ASSOCIATED

The Battery Chargers Professional Technicians TRUST

PTEN PEOPLE'S CHOICE 2020 AWARD WINNER

2020 PTEN INNOVATION AWARDS AWARD WINNER

TOP 20 TOOLS MOTOR 2019

IBC6008MSK

- Safely charges ALL 12V EFB (Start-Stop), AGM, Lithium, Gel and SLA battery types
- Customize battery charging profiles with adjustable voltage and adjustable amperage by type
- Built-in reflash power supply and memory saver port with 12 ft. OBDII cord
- Patented Intellamatic® smart charger analyzer technology with battery rejuvenation
- Partial Charge mode for busy shops
- Energy efficient and OE manufacturer approved
- Legendary power and generational quality
- "Safe in any weather" operation

6006AGM/6009AGM/6012AGM

- Upgraded "tried and true" heavy duty chargers with setting for AGM batteries
- Improved energy efficiency
- Legendary power and quality

AMERICAN MADE, FAMILY OWNED

5043 Farlin Ave. | St. Louis, MO 63115 | 800-949-1472 | *www.associatedequip.com*

#IWANTTHEBLUEONE

Who should pay for the courtesy check?

When did it become the norm to start giving away our time for free to customers?

BY BRIAN HUNNICUTT // Contributing Editor

The reason we do a courtesy check is to make sure the customer's vehicle is safe and reliable. What we get out of it is a higher average repair order, busier shops, techs, and front counters. It is good for the customers, and it is good for us.

Courtesy Checks Aren't What They Used to Be

When I went to get my oil changed and my tires rotated and balanced, a service advisor asked me if I wanted the complimentary courtesy inspection or the comprehensive digital vehicle inspection for $75. My heart started beating faster, and it was a life-changing moment for me. We have always done it for free and here is this guy who wants to charge for it! I went to a different shop like I always do because I enjoy seeing what is new and exciting in our industry.

I asked this tech what the difference was. He responded that the complimentary courtesy inspection was a visual-only inspection, and the Comprehensive Digital Vehicle Inspection went a lot further. Since I was already going to have the tires off during the rotation, they would be taking the brakes apart to whatever level they needed to in order to mic everything while doing a complete brake inspection. He also mentionred that if I had anything sticking that they could in fact be freeing items up and it could make my brakes last longer.

In addition, they would put a thermometer in my dash to make sure the temperature went down to where it should be and the AC compressor was cycling properly. Rest assured,though, they would not be putting the AC gauges on as that could make the system lose refrigerant and weaken the Schrader valves. He did not go over the entire DVI but truly enhanced it. He ended with that they would tap into my OBD-II system and check to see if any of my computers needed updating, just like my phone or computer at home would need to be updated.

I of course said yes, even knowing that I had just had the entire vehicle gone through on my last visit to a repair shop. I had 65K miles on my vehicle. When they got done, and I did not need anything, he still walked me through the very detailed DVI and showed me how great my vehicle was. I walked out of there feeling great even knowing that it did not need any services to begin with.

ADOBESTOCK_287534458.JPEG

Implement a good, better, and best program

Does your shop do a pre-purchase inspection? Most shops do, and they charge around an hour to do so. If you had a good, better, and best program, you could charge an hour for the best, half an hour for the better, and free for the good. Have a laminated sheet at your front counter to hand to the customer and ask them which one they would like. Most will choose the better option. Now, your techs are getting paid to do DVIs if they are on a flat rate, or the shop is getting paid if they are already paying the techs to do it.

It makes no sense to be free

With a free courtesy check, the customer is not paying, and neither the tech nor the shop is paying. This way the customer can pick up the tab for their vehicle, it is their responsibility, after all. Think about it this way: back in the day, I would go to a print shop and pick up 5,000 paper courtesy checks, and they would last as long as they did at the cost of $25 to $30 a thousand. No muss, no fuss.

Now think about it from a shop owner's perspective. First, you must pay for the DVI service every month.

In most cases, you also had to do one or more of the following:

- Upgrade the computer and at least add another monitor.
- Upgrade the Wi-Fi at a huge expense and pay more every month.
- Buy tablets that will have to be upgraded periodically.
- Beat, bludgeon, and coerce the techs to get trained and then use them every time.

With this in mind, you realize it takes the techs longer, and it takes the service writers longer. When you read or say this out loud, it makes no sense to do it for free! Seriously, think about it.

We would only perform it no more than twice a year unless they really drive a lot more than average. The customer could then make a truly educated decision about his or her car and whether to keep or replace the car.

When I rolled this out to the 2nd in Command 20 group, the beginning consensus was how can we charge for something that we have been doing for free? One of the new members responded that they had been doing it for quite a while. When they took the shop over from their parents, the number one complaint was that the techs were not getting paid to do DVIs. They went to their parents and asked if they would pay the techs and were told no, so they decided to ask the customer to pay for it.

I don't like the term "bottom feeder," but there are people who will never take care of their vehicle properly. So, if you really try to get them to understand why they need to take care of their vehicle and what is in it for them, we have a higher chance of making a great customer out of them. The aforementioned shop went from a 50 percent conversion rate to a conversion rate of over 90 percent. This happened in a very short period because they made the customer uncomfortable not buying it instead of making the front counter uncomfortable asking for it.

Here's who pays for the courtesy check

The customer should be the one paying, since they bought the car, drive the car, reap the benefits of having the car, and are the ones responsible for it. When did it become the norm to start giving away our time for free to the customers? What other industry does that?

The next part is, why should the techs keep working for us if we are not paying them for their time? If the tech handles three cars a day and it takes half an hour to do a DVI, then fifteen cars at half an hour make nearly eight hours that they worked and did not get paid for it. I don't know about you, but that does not sound like how to make a happy employee. You also realize that it takes the normal tech way longer than that to perform the DVI, right?

If only 50 percent of the customers buy, and they only buy the service option for half an hour, the math is straightforward. Seventy-five dollars x 7.5 cars equals $562.50 a week for each tech in added income for something we should have been charging for all along. So, if you have three techs, then it is an additional $1,687.50 a week in income.

BRIAN HUNNICUTT, CEC, PFP, has been in the automotive industry since 1978 and is an executive coach for the Automotive Training Institute (ATI). Often called in as a troubleshooter, Hunnicutt is an innovative thinker with a history of reviving failing stores, consistently breaking sales records and exceeding expectations. He helps auto shop owners effectively apply successful, practical methods and systems, rather than theoretical techniques. ATI's 34 full-time, certified coaches have helped ATI's members earn over $2.5 billion in return on their coaching investment since ATI was founded.

THE FUTURE IS NOW:
THE IMPORTANCE OF ADAS SERVICE TRAINING FOR VEHICLE REPAIRS

NEARLY EVERY NEW VEHICLE BEING MANUFACTURED AND SOLD TODAY HAS AT LEAST ONE FORM OF ADAS OR ANOTHER. IT'S TIME FOR TECHNICIANS AND SHOP OWNERS TO ACKNOWLEDGE THAT THE FUTURE IS HERE.

BY DUANE "DOC" WATSON // Contributing Editor

A decade ago, it wasn't especially common for technicians to encounter cars with advanced driver assistance systems (ADAS) in their shops. For many, learning how to repair and recalibrate ADAS was a distant concern for the future. That's changed drastically in the years since. Nearly every new vehicle being manufactured and sold today has at least one form of ADAS or another. It's no longer an option for people to add to their cars; it comes as part of the standard vehicle package. Given the state of ADAS, it's time for technicians and shop owners to acknowledge that the future is here.

The ADAS advancements over the last decade, and especially the last five years, have had great advantages for driver safety. It's why we're seeing more and more ADAS in vehicles, and that number will only continue to grow. Features can be as simple as automatic braking systems or as complex as multi-camera and multi-sensor systems for automatic parking and self-driving. That said, these new technologies bring with them many new challenges for technicians. Since ADAS is currently not standardized across OEMs, or even across vehicles within the same OEM, technicians face several learning curves when it comes to dealing with ADAS.

Embracing training is of the utmost importance in this new landscape. The sooner technicians learn how to repair and recalibrate current ADAS on vehicles, the bigger the opportunity and advantage they will have going forward.

The necessity and opportunity of training

It's completely understandable for technicians and shops to have some trepidation around learning new skillsets, especially when ADAS systems involve elements such as programming. It's important to acknowledge, however, that ADAS isn't going anywhere. It might seem like you can get away without training to diagnose, service, and calibrate ADAS, but that feeling won't last. The bright side: Committing to training sooner offers shops and technicians an incredible amount of opportunity for revenue and service growth.


COURTESY OF BOSCH

WHETHER OR NOT a technician can service the ADAS itself is the difference between making an additional service sale or having to outsource to another shop and losing that revenue.

We used to see huge markets for ADAS services in major cities and along the coasts, since those were regions with larger numbers of high-end cars. But what was previously limited to high-end cars in metropolitan regions has spread across the country. ADAS is in every vehicle, from luxury cars like Mercedes and BMWs, to pickup trucks, like Ford's F-150, to modest, affordable models from manufacturers like Hyundai. It does not matter where in the country a technician is located; they will have to work on cars with ADAS.

Take this scenario: A customer backs into something, breaking his or her taillight, and brings the car to the shop. In years past, a technician might take a look, replace the taillight, and the repair would be complete. Today, however, that broken taillight might affect a rearview camera that's part of the vehicle's ADAS. Now


OPTIMUM
IGNITABILITY
MAXIMUM
PERFORMANCE
Autolite
IGNITING YOUR PASSION
Today's engines need advanced ignition for ultimate performance. Autolite® spark plugs are engineered to deliver optimum ignitability, durability and acceleration for every passion – on and off-road.
Ignite your passion at autolite.com

what happens? Does the technician take that job on, or will the shop have to subcontract that out to a different shop or dealership that knows the proper training and has the equipment to service the car's ADAS?

Whether or not a technician can service the ADAS itself is the difference between making an additional service sale or having to outsource to another shop and losing that revenue.

Training is already the number one priority for anybody working in this industry. ADAS repair is especially critical, since it's a specialized skillset that will continue to change as systems evolve. Technicians who can offer ADAS services today are at a great advantage. Not only do shops that offer ADAS calibration and repair see an increase in revenue from ADAS-specific requests, but their overall business can grow as they build trust with customers, who increasingly own ADAS-equipped vehicles.

Shops and technicians who invest in ADAS training earlier will have a leg up on the competition. And those technicians with ADAS expertise today will build a strong foundation for handling ADAS concerns of the future, allowing them to further develop their skills in step with evolving technologies.

Steps to take to start ADAS service

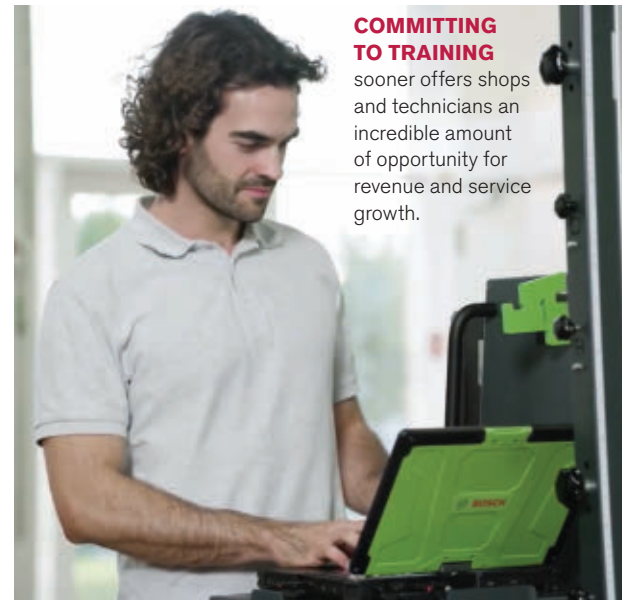
Let's say you're a technician or shop owner who's convinced it's time to get into ADAS repairs. Now the question is, where do you start? There are several factors to consider when it comes to training and adapting to ADAS servicing in general.

As noted, there's not a lot of standardization across ADAS systems, and therefore, ADAS repairs. Different OEMs have different methods, target styles, and procedures. The first step a technician or shop needs to take is to get familiar with what kinds of ADAS are on the market. Do your research. Carefully consider what specific systems you might want to take on.

The next step is to get an understanding of the basics of ADAS. Say you plug the scan tool into a vehicle and particular codes come up that have to do with ADAS. A technician working on ADAS should be able to answer questions like: Is this something I can recalibrate dynamically via a road test, or does it have to be a static calibration in a facility with fixtures and targets? Do I need another piece of equipment? What piece of equipment would I need?

Most shops in North America can easily calibrate ADAS in domestic vehicles today. These, for the most part, only require a scan tool since they mainly rely on dynamic calibration. Repairs might be more complicated, but as far as calibration goes, there's not much training required.

Moving into some of the Asian and European OEMs, calibrations and repairs become a bit more complicated. Mainly, these cars require more tools and space. Every manufacturer has a different target, and some have multiple targets, for calibration. When it comes to expanding ADAS services into these vehicles, shops must consider whether they have the appropriate amount of space. A large space may be needed to allow for the size of the vehicle, the calibration equipment and the clear area required by the OEM around both the vehicle and the equipment during calibration.



COMMITTING TO TRAINING sooner offers shops and technicians an incredible amount of opportunity for revenue and service growth.

COURTESY OF BOSCH

Next, shops must decide whether to invest in sophisticated recalibration systems and tools, with components such as vision sensors, radar reflectors, and surround view floor mat targets. These recalibration systems require additional training, as they must be set up at precise distances from the vehicle, taking into consideration the specific pitch, height, angle, and roll in relation to the vehicle's targets. While this might sound daunting to take on, there are solutions that are intuitive and walk technicians through the process of precise positioning.

This equipment, however, does come with a high initial investment, costing upward of tens of thousands of dollars. It is likely one of the bigger decisions a technician or shop will make when it comes to their ADAS capabilities. While it is a large investment, there are recalibration systems available that are future-proofed and modular, ensuring that shops can affordably upgrade the existing equipment without having to buy an entirely new system as future ADAS technologies are introduced.

That said, technicians will want to get a grasp of making these simpler repairs and calibrations before getting into the full-blown ADAS. That's where decisions around training come in. Technicians and shops will want to investigate training and certification options. You might consider training courses from manufacturers or aftermarket tool companies. Another option is to take ADAS courses from an independent trainer. In the last five years, more independent training companies have cropped up in response to ADAS service demand, and they're amazing resources for technicians wanting to get into the field.

Once a technician is equipped with the knowledge and skills to repair ADAS, he or she can consider becoming certified to

demonstrate their expertise. For example, the National Institute for Automotive Service Excellence (ASE) recently introduced an ADAS-specific specialist certification test. Technicians who pass the test are deemed qualified to diagnose, repair, and calibrate ADAS on automobiles, SUVs, and light-duty trucks.

Shops will need to consider what they can take on, and what opportunities make the most sense to their space and skillsets in this diversified landscape. With the right training and equipment, there's definitely a great opportunity for investment-return.

Beyond ADAS

It's worth mentioning that ADAS does not exist in a silo. Shops and technicians today need to understand that even the most basic repair that they have been doing for the last 20 years could affect a vehicle's ADAS.

As technicians progress farther into learning about ADAS and making those repairs and calibrations, they also need to think holistically about the vehicle. Yes, training on specific systems from specific OEMs is great, but technicians must think of how the repairs beyond ADAS affect the system. For example, unhooking and replacing the battery affects the memory on computers, which in turn affects ADAS. Or a repair as basic as replacing the throttle body has an impact on ADAS.

SINCE ADAS IS CURRENTLY not standardized across OEMs, or even across vehicles within the same OEM, technicians face several learning curves when it comes to dealing with ADAS.

COURTESY OF BOSCH

This is a whole different way of looking at the question of whether to train for ADAS as a technician. There is a whole vehicle picture that is much larger than the system itself, which is even more reason to invest that time and energy into training.

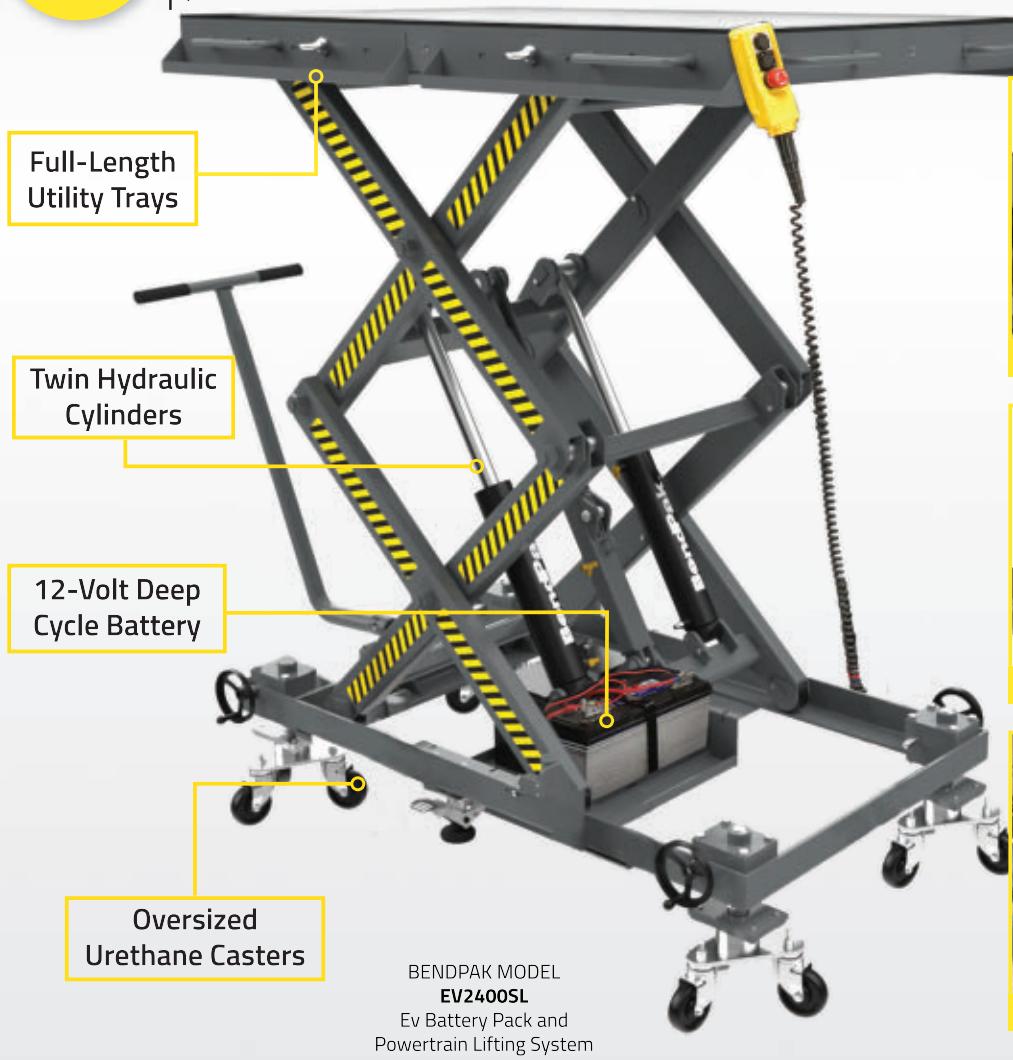
DUANE "DOC" WATSON is a field sales trainer with Bosch Automotive Service Solutions specializing in electronics and vehicle diagnostics.

How do *you* plan to service **EV battery** packs?

The BendPak EV2400SL is a push-around full-rise scissor lift table that is perfectly suited for EV battery pack replacement. With its compact design, this space-saving scissor lift can be easily transported anywhere in the workplace, making it ideal for multi-bay facilities or workplaces with confined areas. To learn more visit **www.bendpak.com/EVLIFT**.

NEW

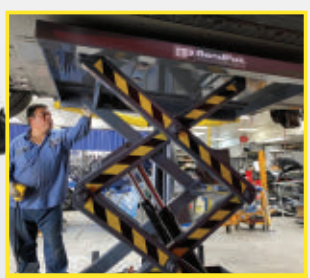
ALL RIGHTS RESERVED PATENT PENDING ALL RIGHTS RESERVED



BENDPAK MODEL
EV2400SL
Ev Battery Pack and
Powertrain Lifting System

Hand Pendant Control

Optional Adapters



Battery-Powered Mobility

1-800-253-2363 • BENDPAK.COM

BP BendPak®

WORK MEETS COMFORT

ROLLING CREEPER SEAT CONVERTS FROM HIGH TO LOW

UP TO 6 LOCKING HEIGHTS

The **ergochair**™ is the adjustable height rolling work seat which will make performing awkward work tasks ergonomically easier and safer. This comfortable creeper seat offers a full range of mobility, increased productivity, and reduced fatigue. To Learn more visit **bendpak.com/ergochair**

TRANSFORMS COMFORTABLY FROM CREEPER TO UPRIGHT SEAT

1-800-253-2363 • BENDPAK.COM

ergochair™

THE SNOWBALL EFFECT: A DIAGNOSTIC TALE

REGARDLESS OF YOUR LEVEL OF TALENT AND EXPERIENCE AS A DIAGNOSTICIAN, SYMPTOMS CREATED BY MAN-MADE FAULTS ARE ALMOST ALWAYS THE MOST DIFFICULT ONES TO SOLVE.

BY CHRIS MARTINO // Contributing Editor

I was called to a local body shop to look at a 2017 Cadillac Escalade for a customer. Over the phone, I was told that the vehicle goes into "limp mode" ever since he had it at a mechanical repair shop. He mentioned the shop broke a connector for the rearview mirror, and ever since then the vehicle would have a bunch of warning indicators on the dash, the steering effort would get high, and the truck would go into a "limp mode." From what he was saying, this sounded like a simple repair: fix the connector, look like a hero, collect money, and move on. Since you are reading this, you can probably tell that is not how it went…

The saga begins

This Caddy has one of those newfangled mirrors with a compass and a video screen that appears when reverse is selected. As I was told, the harness side of the connector was destroyed. The coaxial cable for the video screen was destroyed as well. The shop owner then informed me that the broken harness was only available with the complete headliner, so he did not want to replace it if he didn't have to.

I decided to hook my scan tool up to the vehicle to get a baseline. I always run a complete scan of a vehicle as a rule (**Figure 1**). This lets the vehicle tell me a story. I have been burned too many times by vehicles with cascading failures caused by a component that is unrelated to the original complaint. I was confronted by a plethora of communication codes. As I was reading through this quick test, I felt myself at the top of a steep hill holding a snowball.

I decided to ask the vehicle owner to elaborate a little more on the vehicle's history. He explained to me that this is his personal vehicle that he purchased from a body shop that gave up on it (snowball was just released). Upon further questioning, he then told me that this vehicle had been a total loss, hit on every panel, and had some modules replaced (but which modules?) *Good question: the best answer I could get out of him was "a couple".*

The vehicle ran and drove, so I decided the best thing to do was to bring it back to my shop so I could spend some time with it to properly go through this thing. The first thing I decided to do was to get a diagnostic plan in order.

According to the test plan, the vehicle had chassis CAN codes, engine LIN codes, and broken wiring at the rearview mirror. I wanted to "reach for the low-hanging fruit." In this case, I literally had low-hanging wires, so I wanted to attack that first.

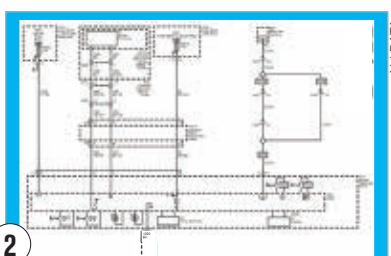
Pulling a wiring diagram, I could see exactly what is on this circuit (**Figure 2**). I could see the main voltage supply, ground, coaxial cable for the video signal, reverse signal, and a driver for the auto dimmer.

The voltage supply comes from the ignition main relay, the ground comes from G210, and the reverse signal comes right from the trailer backup lamp relay. Using some deductive reasoning, I can tell this mirror turns the screen on when it gets a signal from the trailer backup lamp relay. The signal is provided from the coaxial cable. The compass display is all handled internally at the mirror.

What is missing from that diagram? That's right, no CAN bus wiring. There is no way this is causing the customer's complaint (the snowball is starting to grow and pick up speed).

1

I OFTEN FIND IT TO BEST practice to start by scanning all nodes on the vehicle, this lets the vehicle tell you the entire story.



ALLDATA

2

THIS DIAGRAM SHOWS (although being broken) the mirror is not causing the symptom.

3

I HAVE ENCOUNTERED ISSUES with this era of GM vehicles not liking some aftermarket scan tools and wanted to see what a factory tool would tell display.

PATENTED. DURABLE. CARTER.

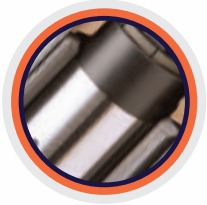
The measure of a fuel pump is how it survives corrosive, dirty fuel tank environments. Carter rises to the challenge with patented pumps that meet or exceed OE standards, offer a limited lifetime warranty† and are IATF and ISO certified. The only manufacturer in the automotive aftermarket with patented module and hanger assemblies on such a wide array of SKUs.

CARTER ENGINEERED QUALITY®

†Carter assemblies, GDI, electrical, universal fuel pumps.

THE CARTER DIFFERENCE IS FOUND IN THESE PATENTED INNOVATIONS

Life-Extending Silver Alloy Contacts on Sender Assembly



Reduction in Fuel Flow Turbulence with Over-Molded Armature

Exterior Guide Rod Springs for Improved Durability*

Pre-Mounted Float Arm to Ensure Proper Fuel Read

Metal Clamps to Prevent Blow-Offs

Abrasion Sleeve Protects Supply Hose from Premature Wear*

Oxidation- and Erosion-Eliminating Carbon Commutator

CleanScreen™ Extends Service Life in Dirty Environments

Noise-Reducing Rubber Feet*

*Exclusive to Module Fuel Pump Assembly.

www.CarterEngineered.com

Avoid the mirage

It was time to consult the quick test again. There were a bunch of communication DTCs, and they were everywhere. I have had experience with this generation of GM trucks causing CAN DTCs with the use of aftermarket scan tools (that's another story), so I decided to hook up the OEM tool (the GDS2), and scan from there.

I ran the codes and cleared them (**Figure 3**). Reading the new results of the factory test, I saw that we had a bunch of DTCs for the chassis expansion bus being offline. This was reported in the power steering module, body control module, electronic brake control module, active safety module, and suspension control module (if the power steering module is down, that would explain the hard-steering symptom).

I tried to do as much research as possible before pulling anything apart. I decided to get a networking diagram for the chassis expansion bus (**Figures 4+5**). Reading this diagram, this seems like a typical GM daisy-chain CAN network, meaning for each module on the network, there are two CAN bus wires going in and two CAN bus wires going out (to the next module). There are also two 120-ohm resistors on the network (one at the beginning, and one at the end).

If you know me, you know I love to scope "all the things." If this is what you are looking for in this article, I regret to inform you that you will be sadly disappointed. This will be pretty low-tech. Anybody still here? OK, moving on…

The DTCs suggest I have a bunch of modules not talking. The best first-test for this is checking for a complete bus. Pins 12 and 13 on the DLC are for the chassis expansion bus (**Figure 4**). Like with powertrain high-speed CAN, I should see 60 ohms between pins 12 and 13 because of the two 120-ohm resistors (**Figures 4+5**). Connecting my meter, I had between 0 and around 1,500 ohms. It's safe to say that something was going on.

I get by with a little help from my friends

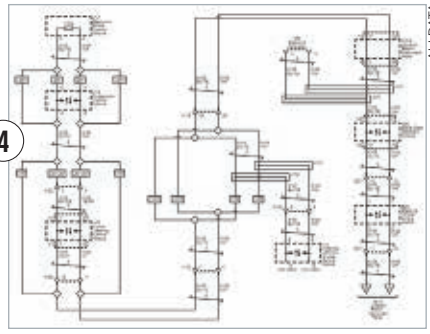
I remembered getting a network diagnostic lesson from Keith DeFazio (from *New Level Auto*). In the lesson, he taught me the best way to attack this is to split the circuit. The issue "should" be on one half of the circuit, and that would offer a diagnostic direction.

The closest (and easiest) testing location would be the steering angle sensor (**Figure 4**). Pins 1 and 3 go to one half of the BUS, and pins 2 and 4 go to the other half. I unplugged the steering angle sensor; pins 1 and 3 showed 120 ohms, while 2 and 4 had that strange reading.

The next logical spot was downstream, the instrument panel junction block (**Figure 6**). This vehicle spent some time outside with the doors off, so there was a distinct possibility that the exposed junction block got wet.

The CAN wires come in on connector X5 and come out at X1. The X1 connector, pins 19 and 20, would be the best testing location (**Figure 5**). This required removal of the junction block. The X1 connector was in the back of the junction block; the pins on the junction block side tested at 120 ohms (a normal value). The harness side showed the strange ohm

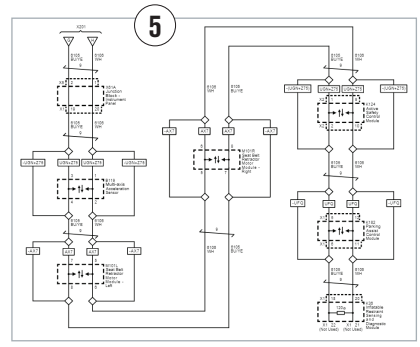
4



ALLDATA

THIS IS THE FACTORY DIAGRAM for the Chassis Expansion bus. This shows the bus configuration and how modules talk to one another.

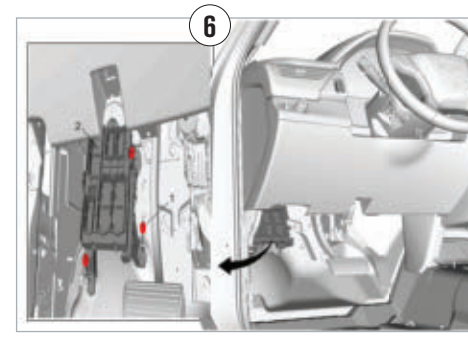
5



ALLDATA

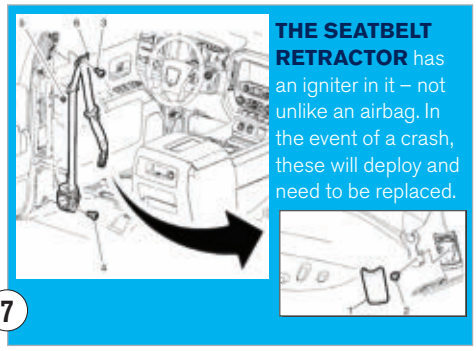
OEM CHASSIS EXPANSION BUS, diagram 2 (Part 2 of figure 4).

6



THIS VEHICLE SPENT some time disassembled with the door removed. This junction box could be a likely spot to find water ingress and corrosion.

7



THE SEATBELT RETRACTOR has an igniter in it – not unlike an airbag. In the event of a crash, these will deploy and need to be replaced.

ALLDATA

8

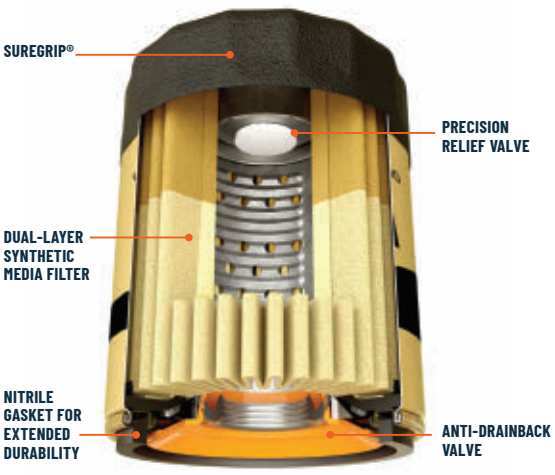
THIS VEHICLE was one good bump away from a serious "thermal event"

9

THE OEM SCAN REPORT FROM GDS2 after jumping CAN wires together. After connecting the CAN-H and CAN-L wires together, the rest of the nodes on the bus began to talk.

WHERE ULTIMATE PERFORMANCE BEGINS

FRAM® ULTRA SYNTHETIC® OIL FILTERS



FRAM Ultra Synthetic® oil filters provide ultimate protection for new and older engines. Optimized for use with synthetic oil, the dual-layer synthetic media filter provides 99%+ filtration efficiency* and up to 20,000 miles of protection. When you want proven performance, you need ultimate filtration.

Find your fit at FRAM.com.

*FRAM Group testing of average filter efficiency of PH8A, 3387A and 4967 or equivalent FRAM TG or EG models under ISO 4548-12 for particles greater than 20 microns.

FRAM®

FRAM.COM

Trusted since 1934

reading. It looked like I'd be moving further downstream.

The next item on the list was the multi-axis acceleration sensor. I did a check on the location of this module. According to the service info, it is located under the center console, right next to the airbag module. If you are familiar with GM consoles, you would realize It would be easier to check the next module in line - the left side seat belt retractor.

The seat belt retractor is part of the wound section of the seat belt (**Figure 7**). To get to it, I had to take off the front and rear sill plates on the driver's side. While I was removing the rear sill plate, I could hear electrical arcing, - not something you want to hear in a car with insulation all over the place.

Once the covers were removed, I could see the extent of the damage (**Figure 8**). There was nothing left of the connector, and the harness was essentially a mound of burned copper. If you touched it, you could see the sparks from the wires.

This was a fire waiting to happen!

I quickly cut all the wires back where the insulation started again (after taking a picture of course). There was the problem!! This most definitely explained the chassis CAN bus codes. I definitely needed to replace the seat belt retractor and pigtail, but I wanted to make only one call to the customer. Was this the only problem? We needed answers.

The way to check if a module is bringing down the bus (in this type of network) is to loop both CAN high circuits together and both CAN low circuits together, effectively bypassing a suspect-module). Typically, it's pin 7 to 8 and pin 5 to 6, or in this case, twist the blue/yellow wires together and the white wires together.

BAM! the chassis expansion bus would now talk (**Figure 9**). The only thing not talking was the left-side seat belt retractor (I would need to install a new pigtail). So, I measured the resistance of the CAN bus wires to the junction box and labeled them (**Figure 10**).

I ran a new quick test and cleared the DTCs, then reran the test to see what was left. The only issue that was of concern to the customer and me was the LIN bus code stored in the engine control module. Looking at the LIN bus network diagram (**Figure 11**), the only LIN component reporting to the engine module is the radiator shutter motor.

This required another call to the shop. According to the customer, this was the original reason the vehicle went to the last repair shop. The previous shop requested them to replace the shutter motor, and the customer obliged. The code is a hard one and will not erase.

Is this a faulty new component?

I needed to hear more about this previous repair. There was a DTC for the fuel gauge circuit, and the shop replaced the sending unit and repaired a wire at the PCM.

With this new information, I wanted to start with the basics. In a situation like this, you need to treat this separate issue as though it's unrelated. Start over, like this is a different vehicle. There is a LIN component not communicating… K.I.S.S. (keep it simple, stupid).

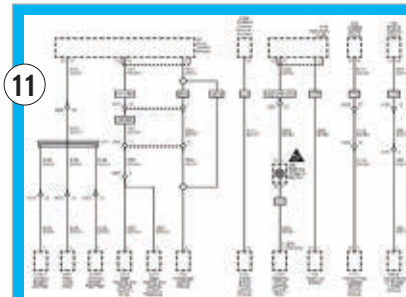
What does a module need to communicate? Voltage, ground, and communication wire(s). It's as simple as that. This grille shutter is hidden behind the bumper cover but in front of the radiator support. I did not want to take the bumper off unless I had to. According to the diagram, connector X106 is accessible. Back-probed, there was sufficient voltage and ground supply. There was also about 6-7V at the LIN wire when the truck was key-on. That voltage means very little to me while using a meter. It tells me that something is happening, but very little as to what.

Generally, with LIN bus, you will have a master and slave module that will output (nearly) a 12V to (nearly) 0V square wave. Sometimes the slave will wake up and transmit;, sometimes it won't. The master will always transmit, waiting for an answer from the slave module(s). I was too lazy to walk two feet to my scope, so I unplugged the X106 connector. While testing, the PCM side of the harness is dead on the LIN wire.

I examined the PCM connectors. I could see where the previous shop repaired the fuel level gauge wiring. The "repair" was covered by a little tape. When I say "covered," I mean it was a piece of tape pressed together over the wire. I removed the tape to re-wrap it. The wire and pin came out of the connector with the tape. THE ENTIRE WIRE AND PIN!!! (**Figure 12**).

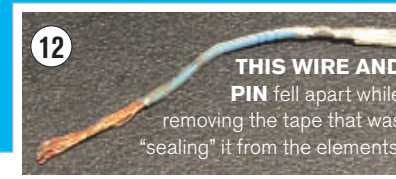
I had to then disconnect the X1 PCM connector, reinstall the pin, and solder the wire back together. While I was there, I wanted to check the LIN wire to the grille shutter but couldn't see the pin. The wire went into the back of the connector, but the pin was gone. I removed the locking

10 **TO AVOID ANY ISSUES,** I needed to measure resistance of the CAN wires to ensure proper placement in the replacement connector.

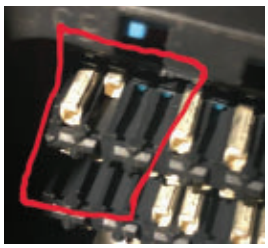


11 **TO BEGIN ANY NETWORK DIAGNOSIS,** you need to see how the network is laid out. A quick look at this diagram displays there is only one module reporting to the ECM on the LIN bus.

ALLDATA



12 **THIS WIRE AND PIN** fell apart while removing the tape that was "sealing" it from the elements.



IT WAS BACKED OUT and not making contact. This would definitely cause a no-communication issue.

cap to the connector, and clear as day, I could see the pin for the LIN wire backed out (**Figure 13**).

I soldered and reinstalled the fuel level wire and pushed the LIN wire back into place. The locks did not engage. Upon closer inspection, the pin locks were broken. This vehicle needed a PCM connector. To verify my diagnosis, I reconnected the X1 connector and pushed the pins in. To nobody's surprise, the LIN code went away.

The verdict is in

I was then able to recommend repairs. This vehicle needed a seat belt tensioner, pigtail, and a PCM connector. The customer authorized the seatbelt tensioner and told me that he would find the PCM connector and wire it in himself.

With the seat belt tensioner repaired and installed with the repair pigtail, I was able to program it and clear all the chassis bus DTCs. The dash had no more warning messages on it and the system never went into limp mode.

The customer decided to live with the broken wires in the rearview mirror until he felt like replacing the headliner. I taped up the exposed wires and reassembled the vehicle. The customer was happy to be able to finally drive his newly acquired Escalade!

There is no greater challenge than man-made faults. But when you are dealing with a series of them on the same vehicle, the difficulty factor is multiplied exponentially. However, keeping your cool and having a solid plan of attack is what it takes to decipher the faults and come out with your superman cape flapping in the wind.

CHRIS MARTINO works in Intelligent Vehicle Support at Opus IVS. He started sweeping floors at his local shop right out of high school. He watched the techs like a hawk and jumped in whenever possible. He's had a passion about this business from the beginning and bought his first repair shop when he was 23. Admittedly, he was in way over his head and had to teach himself everything. He also admits he was a parts changer, as he didn't know any better. After closing down his shop and going back to working for people, he became uncomfortable with part swapping and guesstimating. He picked up a lab scope and read everything he could about voltage and automotive electronics. He retrained himself from the ground up and hasn't looked back. It has become his passion to help others get better and push this industry forward.

DIRTY JOBS: TAKING ON FUEL SYSTEM CONTAMINATION

REMOVING A WEED FROM A GARDEN MEANS LITTLE IF YOU DON'T GET TO THE ROOT. THE SAME HOLDS TRUE WITH REPLACEMENT OF FAILED FUEL PUMPS.

BY DAVE HOBBS // Contributing Editor

Let's be honest. We've all faced doing a dirty job to fix a problem that we either denied existed or spent too much time complaining about. Usually, the last advice we ever want to hear is "deal with it!"

At the risk of some Motor Age readers flipping to the next article with that kind of intro, I'd like to address an age-old problem that you might think either doesn't exist today or isn't very common, fuel system contamination. More importantly, I'll offer practical suggestions to help you deal with it. To keep this simple and brief, I'll focus on gasoline fuel system contamination from the aspects of the denial and aftermath, the sources, and the ways to "deal with it."

Trouble-free fuel systems?

As a young technician in the 1980s focused on driveability and electrical diagnostics, I saw plenty of fuel system contamination. I quickly learned that carburetors have never been trouble-free and that the age-old problem of contaminated gas tanks, combined with the new problems associated with computer-controlled emissions systems, made vehicles even less trouble-free.

Then came fuel injection, (no more troublesome bowl floats, needles/seats, and plugged jets), followed by plastic fuel tanks (no more rust), and finally the returnless fuel systems (no more fuel filters to change). Life in the bay working on fuel systems should be easy now, right? Replace a few fuel injectors and maybe an occasional GDI high-pressure pump. Modern fuel systems have finally been perfected (NOT!). Modern returnless fuel systems (even in GDI-equipped vehicles) But we still have problems because of fuel system contamination!

Contamination . . . denial and aftermath

Let's talk about the denial aspect of contaminated fuel systems. "I rarely see contaminated gas tanks." **(Figure 1)** I've heard that statement from lots of technicians in training classes and on hotline calls I've been involved with, but the contamination aftermath is a reality. How can I prove that? Have you ever dissected (torn down) a modular (in-tank) fuel pump assembly that failed for reasons other than high mileage or old age to try to figure out what made it fail so soon? My engineer friends call this "failure analysis" and have performed many thousands of

YOUTUBE/DELPHI

THIS TANK APPEARS TO BE CLEAN, at least from this view. But the entire tank must be clean!

AFTER THE ELECTRIC PUMP is removed from the plastic module assembly, the metal cylindrical electric pump can be snipped (as shown) or scored with a pipe cutter (heavier cast body motors) to be completely dissected to inspect the impeller, turbine, check valve and armature/brushes.

SOURCE NORTH AMERICA CORPORATION

WHILE IT WOULD BE DIFFICULT to get the larger diesel fuel pump nozzle to fit into a gasoline vehicle's smaller diameter filler neck, the opposite (gas accidentally pumped into a diesel fuel tank), E85 would be easy to pump into a non-flex fuel vehicle. Either way, a complete fuel system flush would need to be performed in addition to repairing the damage the wrong fuel might cause.

Expect More. Expect TYC.

QUALITY, SELECTION, CONVENIENCE

From Headlights to HVAC to Electrical parts, TYC has you covered. With a commitment to quality products that are parallel to the Original in terms of Fit, Form and Function, TYC automotive products provide incredible value for you and your customers.

AUTOMOTIVE LIGHTS

MIRRORS

CONDENSERS

COOLING FAN ASSEMBLIES

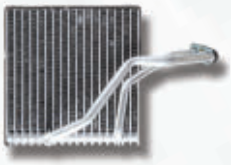
CABIN AIR FILTERS

STARTERS

ALTERNATORS

RADIATORS

BLOWER ASSEMBLIES



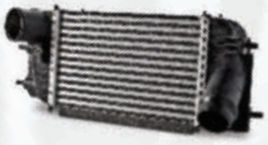
EVAPORATORS

WINDOW REGULATORS

FUEL PUMPS

HEATER CORES

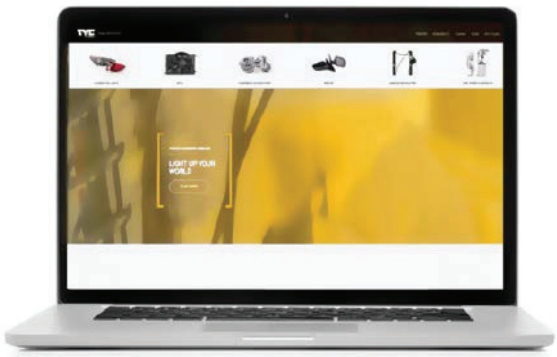
TRANSMISSION OIL COOLERS



CHARGE AIR COOLERS

FIND YOUR ONE-STOP SHOP

For more information about our replacement automotive parts and to order TYC parts, please contact Tri-State Enterprises. You can also look up TYC parts in our convenient e-catalog located at www.TYCUSA.com



them. I like to call it a fuel pump "autopsy" and have personally performed several dozen. My engineer friends told me that most fuel pump failures are due to contamination. I'm a typical auto tech, so I'm skeptical of anything an engineer tells me. "You guys just need to make better fuel pumps – deal with it!" Then I did a few fuel pump "autopsies" and had to agree they were onto something **(Figure 2)**.

Forms of fuel system contamination

1. ENVIRONMENTAL (DIRT AND WATER)

Sand, dust, and dried leaf particles tend to be present in every driving scenario, ranging from the obvious (unpaved roads and off-road driving) to the less obvious examples on paved roads. Ever looked at all the dirt and debris along roads, highways, and bridges? It's getting worse as roads decay from lack of maintenance, and the old-fashioned street sweepers are rarely seen these days. The vacuum of vehicles racing down the road at highway speeds pulls the dirt, sand, and grime into the air. If it wasn't prevalent, we wouldn't need an air filter for the engine!

Next is water. Fuel tank condensation is a reality. Anywhere there is air, there is humidity and condensation. Rainwater is another environmental contamination source. Rain entering your push lawn mower gas tank when left outside with the gas cap off is an easy mental image, but what about modern vehicles with "fairly" sealed-up fuel tanks? Don't rule out rainwater for older vehicles with rusted-out filler necks, missing gas caps, damaged capless filler neck flappers, and, as I'll cover in the section on sources of contamination below, evap canister vent locations.

2. WRONG FUEL/BAD FUEL

This is a category we've all seen on numerous occasions. Classic examples are gasoline added to a diesel vehicle (and vice versa), E-85 in a non-flex fuel vehicle, and stale fuel (turned to varnish). Incidents of E-85 put into the non-flex fuel vehicles are not as bad as they used to be thanks to regular octane fuel prices being within a few cents of E-85 in locations where it is available **(Figure 3)**. Besides the notable lack of energy (compared to E-10), the gas can result in everything from no starts to lean codes, and damage to elastomers (discussed below). Testing for alcohol is simple using a graduated cylinder, a fuel sample, and some water.

3. ADDITIVES

Since the banning of leaded fuel in 1996, we've not had to worry much about the lead in gasoline wreaking havoc by coating O2 sensors and plugging catalytic converters. But you might be surprised to learn that if your customer's vehicle still has a metal fuel tank, adding excessive amounts of fuel system cleaner, octane boosters, fuel storage stabilizers, and gas line antifreeze can, over longer periods, wreak similar havoc. Metal tanks (there are a few still out there) use a special plating (terne plating) to keep the welded seams from rusting.

DAVE HOBBS

HOW DID THE INSECTS GET INTO THIS 2021 Toyota Sienna's in tank fuel pump? Did they fly in or swim in? Nearly a dozen were found on this low mileage van under the fuel filter assembly's screen / media.

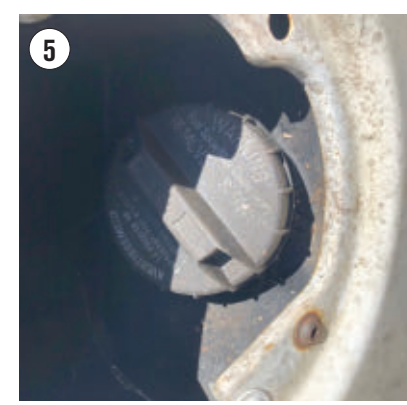
Prolonged use of additives or E85 (both containing alcohol) can emulsify (dissolve) the terne plating. The plating is a tin-lead alloy, so now lead is in your fuel system. Elastomers (rubber seals & O-rings) throughout the fuel system will also begin to emulsify from E-85 (unless the rubber is rated for it) and excessive concentration of other liquid additives. Fuel leaks and evap DTCs can be the result.

Sources of fuel system contamination

1. EVAP CANISTER FAILURES AND EVAP VENTS

If you ever worked on vehicles with carburetors and evaporative emissions canisters, you may recall seeing evap canister failures that resulted in having to rebuild a carburetor (due to charcoal contamination). The canister (due to flooding from the carburetor or an overfilled gas tank) would fail in a manner that caused the activated charcoal granules to break up and enter the carburetor through the bowl vent. Fast forward to 2022; no carbs to worry about finding charcoal in, but we do see it in the evap purge solenoids and occasionally the fuel tank. What about evap vents? The mud daubers, bugs, **(Figure 4)**, and spiders that nested (and rainwater that flowed) into the evap vent filters on GM pickup trucks a few years ago resulted in a TSB. It instructed techs to relocate the evap vent

RAY EDWARDS



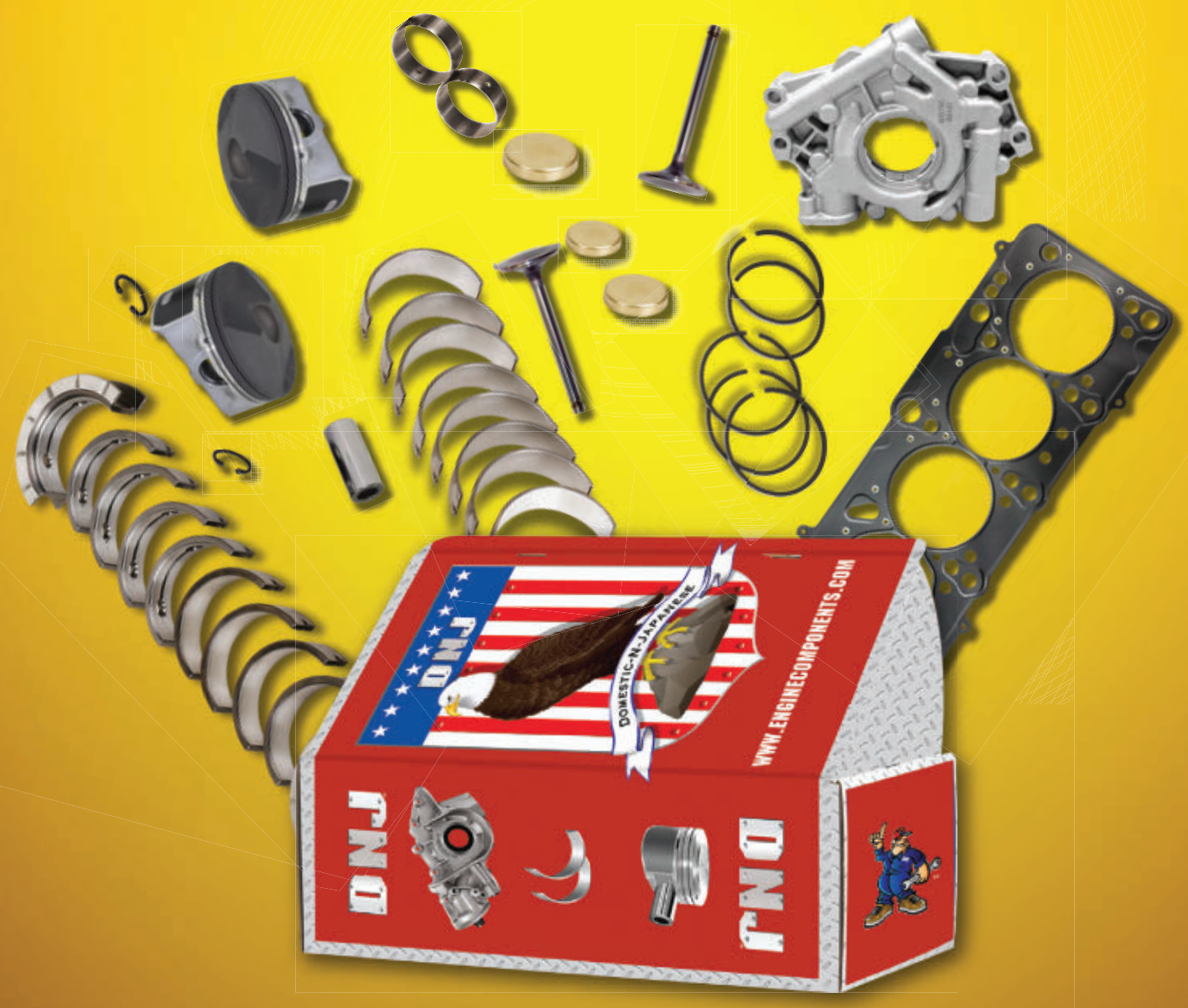
FUEL TANK FILLER NECK OPENINGS are another possible path for environmental contamination.

DNJ®

ENGINE COMPONENTS

FULL LINE SUPPLIER

OF ENGINE PARTS



ENGINECOMPONENTS.COM

and associated hose to prevent future evap-related problems.

Another evap-related TSB from Nissan comes to mind. The TSB says to remove the evap canister from a suspect vehicle and place it on a postage scale, then compare its weight to a new/known-good evap canister of the same part number. If the one on the vehicle is heavier (by a specified amount) than the new/known-good part, and there are no signs of liquid gasoline dripping out of the canister (gas could also make it weigh more), the conclusion is excessive contamination (dirt) in the canister. The fix is to replace it.

Typically, unless you smell raw fuel, evap problems manifest as MILs with DTCs or problems in filling the tank at the gas station. If the evap system has restrictions on the vent side, the air internal to the fuel tank won't be able to escape into the canister (where vapors are adsorbed by the activated charcoal) and then on out to the atmosphere via the canister vent/filter. My conclusion is this; if all this dirt is a common problem with evap canisters and evap vent filters, wouldn't it stand to reason that at least "some" of this dirt is getting into the gas tank?

Gas tanks are like people; they breathe. They exhale with a full tank of cool fuel after a gas station fill. As the cool fuel begins to warm in the tank of a vehicle parked on a hot parking lot (summer day), it will expand and create vapors. Where do they go? Into the evap system to be absorbed. When does the gas tank inhale? When your customer drives the vehicle on longer trips. As the fuel level drops, there must be a means to allow fresh air to take up the unused space in the tank once occupied by fuel. If there wasn't a vent to the gas tank, it would "oil can" (collapse) as the fuel level went down.

Part of the vent system is the evap vent/filter (remember that source of dirt?), but if negative pressures (vacuum) build beyond the ability for the tank to keep its shape, (as with a plugged evap vent) the fuel cap/capless filler neck flapper valve is designed to perform vent duties as a backup to prevent tank deformation. That means the area around the filler neck **(Figure 5)** is a potential source for contamination, not only when you fill the tank at the gas station (and expose the tank to dirt) but when you drive!

2. THE FUEL SUPPLIER

The advice we give every customer on not getting gas when the tanker truck is refueling the underground tanks has been debunked as misinformation, like about everything else (true or false) these days. The argument has always been that the tanker "dumping fuel" into the station's underground tanks is stirring up the water and sediment that lurks at the bottom of every tank. So don't fuel your vehicle at that station.

The truth is, it depends on the design of the underground tanks, the maintenance of the gas pump's filter, and several other factors. Modern high-volume fuel retailers usually have their act together when it comes to gasoline underground storage tanks (UST) and contamination **(Figures 6 + 7)**. I've emphasized "usually" for a reason, as unforeseen things happen. High volume can lead to low volume during pandemics and economic downtimes. Retailers can be put on C.O.D. until their account with their wholesaler is paid. That means they're more likely to be "running on empty" from the bottom of their USTs. The same applies to your fleet customers who have their own fuel USTs.

Case Study:

I stopped by an auto part store a couple of years ago to buy a part for my personal vehicle. The counterperson recognized me and said, *"We've had mostly good luck with your company's line of fuel pumps, but we had a string of defective pumps. It was four in a row, on the same vehicle. The shop finally put in a _____ brand fuel pump and the vehicle seems to be fixed now."*

I can never resist helping another tech solve a mystery on a vehicle with repeat problems. So, I asked the counterperson if I could have one of the warrantied fuel pumps, have the part number of the other brand that "fixed the vehicle," and get any other clues to help figure out what went wrong. I found out the pump that finally "fixed the vehicle" was indeed another brand (but we made that part as well). We made it to the exact same specs as the four that failed! Did the brand name on the box make a difference? No. I also found out that the shop's customer (that the four pumps went into) was a pickup truck with huge tires and a lift kit. Did that make a difference? No.

The fuel pump I was handed (replacement number three) was covered

SOURCE NORTH AMERICA

6

THIS FUEL DISPENSER FILTER is a good first-step to preventing fuel system contamination.

7

SOURCE UNIVERSITY

PREVENTING CONTAMINATION from entering underground tanks like this one can save a lot of hassle for a lot of people.

It Pays to be ASE Certified!

In celebration of ASE's 50th Anniversary, Federated Auto Parts is awarding

$50 A WEEK for 50 WEEKS to ASE Certified Technicians.

SPECIAL BONUS - Win $500 during Weeks 51 and 52

If you're already ASE Certified, just go to federated5050challenge.com and enter for a chance to win every week, for fifty weeks. If you are not yet certified, visit federatedautoparts.com and click on the ASE icon to learn how to register for the ASE test. Once you've completed your certification, you're eligible to enter. It's as simple as that.

It pays to be ASE certified, both for you and for your customers. Challenge yourself today!

ASE 50th Anniversary 1972-2022

Federated Auto Parts®

DAVE HOBBS

THIS STRAINER IS THE LAST LINE OF DEFENSE against fuel pump wear and premature failure. Replacing the pump without cleaning the tank will likely lead to a comeback.

with dirt on the top of the unit. Did that make a difference? No. I took the pump home and did a teardown (autopsy) of the modular fuel pump. Not only was the exterior of the pump dirty, but the modular reservoir (bucket) also had a large amount of dirt/sediment inside. I went further with the "autopsy" and found the internal strainer was full of dirt and there was plenty of debris in the pump's turbines as well **(Figure 8)** ... Case closed.

The shop didn't fix its customer's truck with a brand X over brand Y (they were the same); the shop fixed the truck by cleaning the tank via four non-serviceable (lifetime) filters in the four replacement fuel pumps. That's one expensive way to clean a contaminated gas tank!

The shop called the customer, who admitted to doing a lot of off-roading, including some mudding. Is there a fuel pump that will withstand that? It would be better to look at moving/modifying the evap vent filter to make it serviceable! Then I recalled my youthful wrenching days when Hobbs Auto Electric tune-ups on every GM vehicle included an inexpensive "powder puff" charcoal canister vent filter – to keep dirt out of evap canisters (and fuel tanks).

No visible presence of contamination inside the tank?

Sometimes the tank has no signs of contamination in it. Even if you drain it and run an inspection scope to look at every nook and cranny, there may not be any visible contamination. The contamination may be located inside the fuel pump assembly. How does this happen?

In some applications, the fuel may be drawn (including dirt) very efficiently into the pump, where the contamination will stay. With a normal amount of dirt over a normal lifespan of a pump's internal filter, there should be no problems. But with an above-average amount of "garbage" into the tank, the pump's internal filtering may fill up and create a problem for the pump. If the strainer/screen before the pump restricts, pressure and/or fuel volume may drop, and the pump motor may cavitate and manifest as a driveability problem. Do this long enough, and the pump could die an early death from overheating. Fuel is what cools the pump.

If the filtering media after the pump (but still internal to the assembly) fills up/restricts, the same pressure/volume/driveability symptoms may occur, but the pump could overheat from higher than normal current (amps) over the long haul. Without an external inline fuel filter (frame rail mounted filter from old-school return line system technology), all filtering is done inside the fuel pump assembly. Look up the flow rate of a modern in-tank fuel pump. Whether it's a 12-year-old pickup truck with SFI or a newer passenger car with GDI, the modular (electric) fuel pump that pushes the fuel from the tank to the engine compartment has a flow rate spec somewhere between 25-35 gph (gallons per hour), depending on the exact application. Generally speaking, the entire contents of a fuel tank move through the fuel pump (and its internal screens/filtering media) at least once every hour!

Conclusion

If you do see dirt, rust, or other contamination in a fuel tank when you're ready to replace a fuel pump, drain and remove the fuel tank to perform a complete cleaning of the tank. If you can't figure out how to get paid for all that work, or the fuel pump R&R can be done w/o pulling the tank, at least use a fuel tank cleaning wand that has scrubbing pads with magnets to pick up any ferrous debris from the bottom of the tank. In either case, always do as deep of a fuel pump autopsy as (time and warranty return part rules allow) to try to determine what killed the pump. The last thing you want to do is continue throwing parts at the vehicle/be in denial about the number one enemy of fuel systems – contamination!

Until street sweepers make a comeback and customers agree to only drive on paved roads, environmental (dirt) fuel system contamination will be the natural enemy to fuel pumps and evap systems. Cleaning fuel tanks (when applicable) will definitely help. A new (serviceable) aftermarket evap filter solution would be another idea. Until that comes along, we'll need to continue with the "dirty job" of dealing with fuel system contamination!

DAVE HOBBS is a senior technical trainer and curriculum developer for Delphi Technologies Aftermarket at BorgWarner Inc. He's Master ASE-certified with L1 (advanced engine performance) & L3 (hybrid) specialist certifications.
He has extensive OEM service and field engineering expertise, with more than 30 years of experience in troubleshooting vehicle systems electronics, with 15 of those years in the independent aftermarket repair business. He has 20 years of experience in training engineers (worldwide) and service technicians in both the OEM and aftermarket arenas, as well as experience in working with postsecondary vocational / community college students as an adjunct instructor.

YOU'RE COVERED

Worldpac has the quality OEM brands you trust.

aae Steering Specialists · ACDelco · ADVICS · AISIN · akebono Brake Experts · AP Emissions Technologies · Ate · BANDO · BCA Bearings by NTN

Bilstein · BOSCH · Castrol · Continental · CORTECO · CSF Cooling Experts · Delphi Technologies by BorgWarner · DENSO · elring

HELLA · ISG · KYB · LEMFÖRDER · LIQUI MOLY · MAHLE ORIGINAL · MANN FILTER · METRIX · MEYLE

Mitsubishi · Mopar · Motorcraft · MOTUL · Motion & Control NSK · NGK The Ignition Specialist · NTK The Sensor Specialist · OEF3 · OES3 · PEC Precision Engineered Chassis

PENTOSIN · Professional Driveline · Pro-STRUT · ProTUNE · Red Line · REDLINE · rein Automotive · SACHS · SCHAEFFLER

ServiceTech · TEXTAR · TRW · Valeo · VSV Shocks VSV Struts · WABCO · World Source One · ZF · Zimmermann Brake Disc · Brake Drum

WORLDPAC

worldpac.com | worldpac.ca

Access quality brands, technical training and business solutions all in one place.

Protect Your Customers from Winter Wiper Woes

With winter on its way, it's never too early to get ahead of the snow, slush, ice and all conditions that aren't nice for drivers. Preparing customers before winter rolls in means they have the best chance for safe travels ahead, especially during peak periods. While new tires, a full battery and a fresh oil change will keep drivers on course, they won't be ready to take to the road without a clear view ahead.

Safe winter driving starts with wiper maintenance. After all, the only place for drivers to go when visibility is compromised is right back inside. When it comes to wipers, ANCO® has the answers. Here are a few tips to pass along to your customers to identify and prevent wiper mishaps this winter.

Spot the Three S's

Next time your customers turn on their wipers, have them look out for any streaking, skipping or splitting. Wipers that are in good shape will clear the full field of view across the windshield with ease. If smears are left behind or sections of the windshield are missed by the wipers, there's a strong chance that the blade is being obstructed or has sustained damage.

Take a Closer Look

Customers don't have to be pros to catch wiper damage, but yours can be if they know what to look for. The rubber blade should be secure and fully intact against the frame. If any cracks, tears or abrasions are visible, it's time to find replacements. Wipers designed for snow and ice resistance can give your customers extra protection in harsh conditions.

Fend Off the Freeze

Frozen wipers simply can't provide a clear field of view in any conditions. Luckily, drivers do have a few options to prevent wipers from sticking to the windshield or collecting ice. Lifting the blades up is a simple and effective solution if the vehicle allows for it. Covering the wipers up or wiping them down with rubbing alcohol are also efficient solutions.

Remove Salt and Sand

It can be a major relief to drivers to see salted and sanded roads in winter. The same can't be said for wipers. The tiny granules that land on the windshield can dry out and scratch wipers, eventually leading to damage. Drivers should make a habit of cleaning off their windshield when gassing up in addition to using a warm, wet cloth to wipe down the blades.

Clear Off Nozzles

After a heavy snowfall or deep freeze, drivers should make sure that their washer fluid nozzles haven't been blocked. If no snow is covering up the nozzles and the fluid doesn't come out, the nozzles are likely frozen. Giving the vehicle a couple of extra minutes to heat up should solve the problem. If not, a pin can be used to dislodge the clog.

Unlike other critical components, your customers don't have to look under the hood to check out their wipers. Sparing a moment to ensure their wipers are road ready means they won't be sacrificing their safety later on. When your customers stop by for winterization, make sure their wipers are a part of the conversation.

THE CLEAREST CHOICE IN WIPER BLADES™

Offering comprehensive coverage for passenger cars and commercial vehicles, ANCO® wiper blades are engineered with the latest technology to ensure maximum driving visibility.

Learn more about the entire ANCO line at
www.ancowipers.com

ANCO®

10 TIPS TO HELP YOU STAY SAFE IN THE BAY

It's easy to get complacent at any job. It becomes routine and there are many things you just do automatically. But when your job includes working under thousands of pounds of steel, complacency can put you in danger. Here's a refresher of 10 tips to help you stay safe when using a car lift.

1. **READ THE DIRECTIONS.** You know how to use a car lift. But not all lifts are the same. When you get a new lift or start using a different one, take a few minutes to review the manual, safety stickers, and warnings. Make sure you understand how all the safety systems work.

2. **ONLY TRAINED OPERATORS SHOULD USE A LIFT.** For everyone's safety, keep customers and untrained personnel away from the work area.

3. **DON'T INVENT YOUR OWN LIFT USES OR ADAPTERS.** Lifts are professionally engineered to support their rated load capacity when vehicles are picked up as designed, using only recommended adapters. Using the lift in other ways, like only lifting one end of a car or using wooden blocks instead of the OEM adapters, is asking for trouble.

4. **KEEP YOUR BAY CLEAN AND WELL LIT.** Cluttered, dim work areas invite injuries.

5. **NEVER OVERRIDE SELF-CLOSING LIFT CONTROLS.** Most professional lifts have controls that will stop running if the operator lets go of them. This is an important safety feature designed to ensure the lift only moves when someone is at the controls to make sure the vehicle remains stable. Don't risk a car falling just so you can step away for 30 seconds.

6. **ALWAYS ENGAGE THE SAFETY LOCKS/LATCHES BEFORE GETTING TO WORK.** Review the manual for directions on how to place your lift on its mechanical load-holding devices (AKA locks or latches) before going under it. On many lifts, you must raise the vehicle and then lower it onto the locks, releasing hydraulic pressure in the process.

7. **CHECK OVER YOUR LIFT.** Make it part of your routine to regularly check your lift for damaged parts and components, worn out adapters or other areas of concern. Don't use a lift if any component is damaged.

8. **TAKE CARE OF YOUR EQUIPMENT.** Follow the maintenance and lubrication guidelines in your lift's manual to keep the lift running as it should. Get it inspected annually by an ALI Certified Lift Inspector.

9. **KEEP IT DRY.** To reduce risk of electric shock, most lifts should not be used on wet surfaces or exposed to rain. They should be grounded while in use.

10. **PROTECT YOURSELF.** Wear safety glasses. Stay alert, use common sense, and pay attention to what you're doing—and what the vehicle on the lift is doing. Put your safety first.

RAISING THE STANDARDS OF EXCELLENCE

AP SERIES™

NEW 360-Degree Automatic Swing Arm Restraint System Provides the Ultimate In Safety and Vehicle Fall Protection

BendPak Model
10AP
Two-Post Lift

Certified to meet the standards of ANSI/ALI ALCTV: 2017

Bi-Metric Swing Arms

Our 10AP Series offers the convenience of wide or narrow installation wrapped up into one configurable package. This durable, safe, and reliable car lift features an expandable top beam and BI-METRIC™ arms to suit virtually every vehicle lifting requirement – symmetric or asymmetric. The 2-in-1 design gives operators the option of loading vehicles either symmetrically (centerline of vehicle at column) or asymmetrically (centerline of vehicle behind column). The simple, yet highly sophisticated is sure to keep operating costs low and productivity high. Check out the full line of 10AP lift series at **bendpak.com** or call us at **1-800-253-2363.**

1-800-253-2363 • BENDPAK.COM

BP BendPak®

DIAGNOSING BRAKE HOSE ISSUES

When performing a brake inspection, visually inspect the brake hoses for cracks, ballooning, chafing, separation from end fittings, seepage or other obvious defects. Replace the brake hose if any issues are found.

What may not be seen is an internal problem with the hose. Many hoses include brackets that support and route the hose correctly. As the brackets corrode, they expand and may cause the hose to collapse internally, which is often difficult to detect. (fig. 1).

On vehicles with disc brakes, inspect the friction material for any uneven wear before removal. If the inboard and outboard pads are completely worn on one side, and the opposite side caliper pads have normal wear, determine where the problem is.

Don't assume the calipers are culprits until they are inspected properly. Check all calipers for leakage, slide operation and square cut seal operation. The square cut seal not only retains brake fluid, but it also flexes when the pedal is applied, then returns to its shape after the pedal is released. This action pulls the piston back into the caliper housing. This can be checked with two people; one applies the pedal while the other watches the caliper piston operation (fig. 2). If the piston doesn't draw back in, it may be the square cut seal flexibility or a restriction in the brake hose.

FIGURE 1

One way to check for a collapsed hose is to gravity bleed the system. If both front bleeders are open and one caliper is dripping quickly and the other side is not, there may be a restriction in the hose that is not allowing the caliper to vent. This is like pouring gas out of a can with the vent plug still in. Try breaking open the line at the ABS unit and watch for a drip. If the drip increases, the problem is above that point. Then its possibility sticking of the ABS valve or master cylinder issues. If the drip is the same, it's a possible hose restriction. The very best way to verify the proper operation of the brake hose is to use two pressure gauges mounted in the caliper bleed screw hole. If the pressure builds up or the release is delayed, suspect the hose on the defective side.

The gravity test is quicker. Many technicians remove the hose and attempt to blow compressed air through it to verify. As stated earlier, brake hose failures may be different from one geographic area to another. Areas with severe winters may have hoses fail at a higher rate due to increased corrosion activity. No matter where the vehicle is, don't forget the brake hoses when diagnosing pulls, premature pad wear, overheating brakes and noise issues.

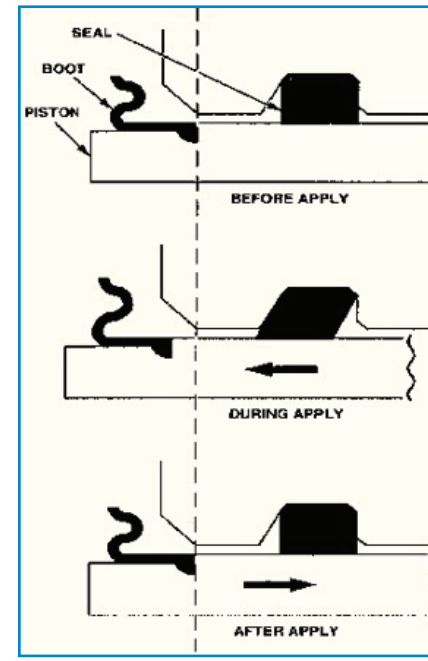


FIGURE 2

Built To Fit

FEELS LIKE OE.
STOPS LIKE OE.

Setting the standard for quality and innovation in braking technology, Centric® brakes are designed, manufactured, and tested to exacting standards. To meet the demands of today's vehicles, our Centric R & D team analyzes the OE product and engineers brake parts that match or exceed OE effectiveness. We continually strive to make sure that Centric parts feel and function just like OE.

Centric® PARTS

CentricParts.com

QUALITY-BUILT BRAKE PADS AND ROTORS POWERED BY MPA

Backed by over fifty years of product innovation and engineering expertise, Motorcar Parts of America is proud to announce the addition of Quality-Built replacement brake pads and rotors to our extensive product portfolio. This full line of brake system components provides a wide range of application coverage and options for every type of driver and vehicle. MPA's global sourcing network has collaborated with leading manufacturers to develop the most comprehensive brake program available in the automotive aftermarket. Quality-Built brake pads are available in four formulations, each engineered for maximum performance and durability in any driving situation. Quality-Built brake rotors feature OE design and metallurgy to restore safe, confident braking for any vehicle.
Quality-Built brake pads are available in four performance levels each designed to optimize brake system performance for any vehicle and driving style.

QB BRAKE PADS BY QUALITY-BUILT

QB Brake Pads deliver like-new stopping power with minimal dust and noise.
- OE matched - application specific formulas
- OE style slots and chamfers
- Multi-layer shims
- Post cured and scorched for easy bed-in Passenger vehicles, SUV's, light duty trucks
- Over 1300 SKU's for 99% light duty VIO coverage

QUALITY-BUILT WORK FORCE BRAKE PADS

Hardworking vehicles need hardworking brake pads, and Quality-Built Work force brake pads deliver every time. Specially formulated friction compounds are designed for high-heat situations that push brake pads to the limits.
- High strength steel backing plates
- Multi-layer noise abatement shims
- Long wearing friction formulas
- OE design slots and chamfers
- Low rotor and pad wear
- Stainless steel hardware included where required
- Post cured and scorched for easy bed-in
- Perfect for high-heat, repeat stop situations
- HD vehicles, towing, fleet vehicles, off-road applications
- Over 500 SKU's for complete coverage for fleet and towing applications

QUALITY-BUILT PREMIUM BRAKE PADS

Quality-Built Premium Brake Pads provide optimized stopping power in all conditions. Application-specific pad formulas remove the guesswork from pad selection by providing friction compounds engineered to restore like-new stopping power for every vehicle.
- OE matched - application specific formulas
- Multi-layer noise abatement shims
- OE design slots and chamfers
- Stainless steel hardware included as required
- Low dust, low noise formulas
- Post cured and scorched for easy bed-in
- Copper-free 2025 compliant formulations
- Passenger vehicles, SUV's, light duty trucks
- Over 1500 SKU's for 99% light duty VIO coverage

QUALITY-BUILT BLACK SERIES BRAKE PADS

Quality-Built Black Series Brake Pads are the ultimate in brake pad performance, delivering smooth, reliable stopping with zero noise and low dust. Black Series friction compounds are engineered for optimized brake system performance and improved stopping power.
- OE matched - application specific formulas
- Enhanced friction formulas improve performance & durability
- Multi-layer noise abatement shims
- Ultra-low dust, low noise formulas
- OE style multi-layer shims for maximum sound dampening
- Precision cut backing plates
- OE design slots and chamfers
- Upgraded OE style stainless steel hardware where required
- Post cured and scorched for easy bed-in
- Copper-free 2025 compliant formulations
- Passenger vehicles, SUV's, light duty trucks
- Over 1500 SKU's for 99% light duty VIO coverage

QUALITY-BUILT PREMIUM BRAKE ROTORS

Quality-Built Premium rotors feature OE style vane designs that promote efficient cooling and improved stopping power in all stopping situations. Q-Shield protective coatings offer extended protection from rust in the harshest conditions.
- OE Style Symmetric Vane Designs
- G11H18 Alloys
- Mill balanced
- Straddle Cut to eliminate DTV
- Non-directional friction surfaces
- Precision machined mounting surfaces
- Installation-ready without cleaning
- Q-Shield Protective Coatings

Q-SHIELD ROTOR COATING

Q-Shield Brake Rotor coatings provide exceptional protection from corrosion and rust without harmful chemicals or plating processes. With complete rotor surface coverage, this environmentally friendly coating withstands exposure to high temperatures without letting go, providing maximum protection no matter what you throw at it.
- Water-based, environmentally friendly coating with no heavy metals
- Coats all internal and external surfaces for complete protection
- Brake pads remove a minimal amount of coating from the rotor surface
- Q-Shield coating does not interfere with initial braking performance
- Installation-ready with no additional cleaning or preparation required
- Reduced installation time and increased profitability
- Excellent resistance to high-heat situations without cracking or chipping

mpa®
motorcar parts of america, inc.

MOTORCAR PARTS OF AMERICA, INC.
2929 California Street
Torrance, CA 90503
www.motorcarparts.com

QUALITY-BUILT TO LAST.®

Trust Quality-Built With Every Stop.

Full-Line Application Coverage
Brake Pads and Rotors for all Vehicle Types
Late Model Coverage
OE Friction Type Matched Formulations
Copper-Free 2025 Compliant Formulations

QUALITY-BUILT™

BRAKE PADS + ROTORS | PASTILLAS + ROTORES DEL FRENO | PLAQUETTES + DISQUES DE FREIN

powered by: mpa®

Scan the QR code with your smart device to learn more about Quality-Built brakes.

CHANGES IN BRAKES

The automobile has gone through many changes over the years. While some are noticeable, like carburetors and fuel injection, brake pads, rotors, drums and shoes look similar to how they did 20 years ago but are really quite different.

Semi-metallic and ceramic brake pads have advantages and drawbacks. Semi-metallic style pads are great for work trucks, performance vehicles and overloaded minivans. Ceramics are great for light duty trucks, everyday drivers and drivers that love clean wheels. How have friction materials changed the way technicians do brake jobs? It's the way the friction stops the vehicle. Semi-metallic lining uses abrasion to stop and is very hard on rotors. The rotor is being worn down every time the pad touches the rotor, which leads to dust on the wheels.


FIGURE 1

Ceramic brakes stop with adhesion. The brake pad leaves an ultra-thin layer of ceramic material on the rotor every time they make contact called material transfer (fig 1). The braking process consists of the ceramic pad rubbing against the ceramic transfer material on the rotor, causing an adhesion stop. This process does not wear down the rotor but increases the thickness of the rotor with every brake. It's also the reason ceramic brakes keep the wheels cleaner. Since the rotors are not being worn down like semi-metallic pads, there is no rotor dust over the chrome wheels.

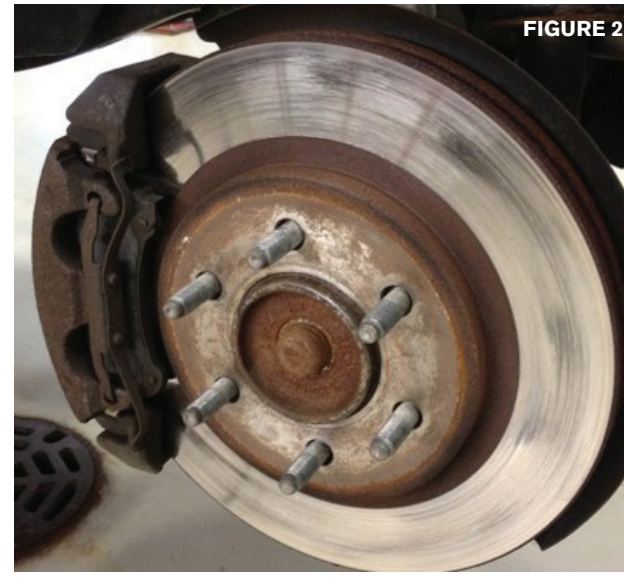


FIGURE 2

The biggest change when servicing brakes today is checking combined rotor/hub runout. With semi-metallic wearing the rotor surface and ceramics adding material, make sure the rotors run true and don't touch the pad unless the brakes are applied. The average allowable runout on today's vehicles is .002". The wheel turns about 800 times a mile, 1.6 million in 2,000 miles. If the installed rotor has .007" lateral runout, the pad will contact a portion of the rotor every revolution. With semi-metallic pads, the rotor is wearing thinner in one area.

Ceramic pads are applying material in one spot (fig 2). As soon as the thickness variation exceeds .001, the driver may start to feel a pulsation in the brake pedal. This is the reason for "warped" rotors two-three months after the brake service. They are not really warped but have disc thickness variation (DTV). Take a couple minutes and clean the hub and check the runout when servicing brakes.

RAYBESTOS HAS THE RIGHT BRAKES

Whether you are working on a passenger vehicle, commercial vehicle or specialty vehicle, Raybestos® has the right brakes for you. The full line of premium quality Raybestos brakes has application-specific features and friction formulations, so you can install them with confidence.

Raybestos®
The best in brakes®

WWW.RAYBESTOS.COM

BOSCH POWERTRAIN SOLUTIONS

World Leadership Recognized Through the Trust of OE Manufacturers

From the first series production of diesel injection pumps and nozzles in 1927 to the DI-Motronic Gasoline Direct Injection System in 2000, Bosch has been shaping the world of mobility through innovative gasoline and diesel systems.

The development of these progressive innovations – and the expansion of engineering and manufacturing facilities in North America – has strengthened our presence in the US and earned us the trust of Domestic, European and Asian Original Equipment Manufacturers (OEMs).

The basis of that trust stems from the pioneering spirit and dedication to delivering high-quality products that founder Robert Bosch instilled when he introduced the first magneto device in 1887. We remain committed to these same core principals today and apply them to the development of our aftermarket parts – ensuring the highest quality, performance and durability to meet Original Equipment (OE) specifications. Meeting OE requirements takes a lot of effort but we believe superior quality is worth it. That's what we call the Bosch OE Difference.

Winning the trust of Original Equipment Manufacturers demands that quality always comes first and we remain committed to OE specifications. When the risk of replacement costs and regulatory non-compliance is so high for OEMs, every part matters and we believe that there is no room for error.

The Bosch OE Difference

Performance, Reliability & Durability

The Bosch OE Difference is based on delivering aftermarket parts that provide the Form, Fit and Function of the original parts – with Function characterized by the following key criteria:

OE Performance – The part performs functionally as the original part did.

OE Reliability – The part performs as the original part did, regardless of any condition.

OE Durability – The part lasts as long as the original part did.

That's why when it comes to vehicle repairs, you can count on the integrity of Bosch OE-quality powertrain parts to build trust with your customers – because your reputation is your business.

Learn more – and hear what shop owners and technicians are saying at: **www.boschautoparts.com/Reputation**

REPUTATION IS EVERYTHING

Bosch has the Domestic, European and Asian ***OEM-trusted*** parts!

BOSCH

ROBERT BOSCH
Oakbrook Terrace Tower
1 Tower Lane | Suite 3100
Oakbrook Terrace, IL 60181
Phone: (888) 715-3616
boschautoparts.com

Invented for life

BOSCH

Reputation is EVERYTHING

Winning the trust of Original Equipment Manufacturers (OEMs) demands that quality always comes first and we remain committed to OE specifications. When the risk of replacement costs and regulatory non-compliance is so high for OEMs, every part matters and we believe that there is no room for error.

The Bosch OE Difference is based on delivering aftermarket parts that provide the **Form, Fit** and **Function** of the original parts – with **Function** characterized by the following key criteria:

OE Performance
The part performs functionally as the original part did.

OE Reliability
The part performs as the original part did, regardless of any condition.

OE Durability
The part lasts as long as the original part did.

Bosch has the Domestic, European and Asian ***OEM-trusted*** parts!

www.boschautoparts.com/Reputation | **www.boschautoparts.ca/Reputation**

PRIORITIZING TRAINING THROUGHOUT THE ELECTRIFICATION OF THE AFTERMARKET

THE INTRODUCTION OF HIGHLY COMPLEX EVS WILL REQUIRE SHOPS TO COMPLETELY CHANGE HOW THEY WORK.

BY NEIL FRYER // Contributing Editor

The aftermarket is set to face one of the most significant changes we have ever seen in the industry. As electric vehicles (EV) become more popular, technicians will need to overhaul their skills and learn how to work on an entirely different technology. Preparation will be key to thriving in the changing landscape.

What does electrification mean for the aftermarket?

Car-buying habits and the aftermarket are inextricably linked. Often, when a new trend, brand, or make emerges, you expect to see more of those vehicles, and their parts, in your garage. But, the phase will pass, and as quickly as it left, another trend will come about. Think of the shift from CD to Aux. to GPS and Bluetooth systems, or keys to keyless entry systems – there are constant innovations in internal combusion engine (ICE) vehicles, but generally, the moving parts stay the same.

For auto technicians, the shift toward EVs is different. The introduction of highly complex EVs will require shops to completely change how they work, but combustion engine vehicles will continue to be a very large part of the active fleet for the next couple of decades, so the change won't happen as soon as you might think.

EV adoption

Though governments, states, and cities, across the world, have pledged to end sales of petrol and diesel vehicles, adoption still varies globally. For example, in U.S, the government hasn't committed; however, cities such as New York and Seattle have. Varied adoption often reflects the questions around the infrastructure EVs require.

Cities are predisposed to supporting EVs — with electricity available city-wide, it is possible to install charging points anywhere, and everywhere. However, in more rural areas, it's trickier. The latest Census recorded around 19 percent of people living in rural areas, which means almost one-fifth of the population lives in a location where it could be difficult to install the necessary network of charging points. Long-haul journeys across vast rural expanses won't be possible for EV's unless that infrastructure is in place.

As well as limitations to infrastructure potentially stalling adoption, standard warranties on EVs will also delay when auto repair shops begin to see an influx in EV requests. The standard warranty for an EV is typically eight years, often extending to the battery for that same time period. So, even as adoption gains momentum, there will still be a delay before EV's are commonplace in independent automotive repair shops.

So, while change is coming, it won't be overnight. In fact, I predict that by 2030 more than 90 percent of the cars on the road will still have ICE (including hybrids). We have time, so how can your shop take advantage of it?

Prioritizing training

Time doesn't mean we should wait; it means we have a better chance at effective preparation. At the moment, second-hand car sales are booming, with difficulties in the supply chain and chip shortages persisting globally. More ageing vehicles on the road inevitably means more problems to fix,

DIAGNOSTICS

OEM REPAIR DATA

WIRING DIAGRAMS

SMARTER SEARCH

LEADING COVERAGE

100% UNEDITED OEM INFO

MODERN PLATFORM

MOTOLOGIC REPAIR & DIAGNOSTICS

TAKE A TEST DRIVE
my.advancepro.com/motologic

UNEDITED OEM SERVICE INFO AT YOUR FINGERTIPS.

MotoLogic gives you quick access to complete, unedited OEM repair and diagnostic information for 99% of vehicles on the road today.

CARQUEST AUTO PARTS | AUTOPART INTERNATIONAL | WORLDPAC | Advance Professional

which opens up a huge opportunity for auto repair shops. So, take on as much as possible, and invest the profits in preparing for EVs with training and new equipment, so you're ready to address the demand when it comes to you.

Training is a necessity. You cannot work on an EV without sufficient training. High-voltages make them exceptionally dangerous for untrained technicians, and one wrong move could result in a serious injury. The vehicle must first be made safe before technicians start work, even to carry out the simplest jobs.

Many auto repair shops are worried about the training requirements, with one-third expressing concern about keeping up with the latest technology in recent global research conducted by Delphi Technologies. But by saving and investing now, continued training will give technicians the confidence to work on the latest technology as it comes into the aftermarket.

Investing in equipment

Alongside training, shops will also require new equipment to work on EVs. The modern automotive repair shop uses multiple tools daily, and without them, they wouldn't be able to repair all the vehicles they see every day. To offer the best service to the EV customer, auto technicians will require EV specific equipment too. Specialized connectors, high voltage tools, and fire equipment in case of emergency, will all be needed throughout the shop as well as many other new tools.

Along with updating equipment, auto repair shops will need to adapt to changing consumer expectations. Seamless online booking processes and apps to update customers when their car is ready for collection will become commonplace. Ensuring customers have an optimum experience will not only make businesses more successful today with the current vehicle fleet but also tomorrow with the new vehicle fleet.

NEIL FRYER is vice president and general manager for the global Delphi Technologies Aftermarket business at BorgWarner. Fryer is a seasoned leader with extensive automotive aftermarket experience that spans his entire career. He acquired his experience from field roles and responsibilities held at headquarter level with Tier 1 manufacturers. He has also worked as a specialist aftermarket consultant. Prior to joining BorgWarner, he was senior vice president at ZF TRW Aftermarket.

PHOTO 39305964 © CHARLES KNOWLES | DREAMSTIME.COM

NEW CLASS 6 AND CLASS 7 BRAKE FLUIDS ARE HERE

"A LITTLE DAB'LL DO YA" MAY WORK FINE FOR HAIR CARE PRODUCTS, BUT CERTAINLY NOT FOR BRAKE FLUID!

KEVIN MCCARTNEY // Contributing Editor

Brake fluid technology has evolved far beyond DOT 3, DOT 4 & DOT 5. Modern antilock brake systems (ABS) and electronic stability control (ESC) are faster and more capable than ever before. Newer electrohydraulic braking (EHB) and autonomous emergency braking (AEB) systems can be even faster yet.

But most DOT 4 brake fluids are not acceptable in this application. Ford service information is far more specific and states that only DOT 4 fluids that meet Ford material standard WSS-M6C65-A2 are acceptable in most modern Ford vehicles. That material standard includes the new ISO 4925 Class 6 ultra-low viscosity requirements.

Time is of the essence

With conventional braking, it takes 300-600 milliseconds to build peak braking pressure after the brake pedal is depressed. Electrohydraulic braking can reduce this to 120-150 milliseconds. Those times are for a simple single brake application. Rapid cycling of brakes in anti-lock or stability control mode creates more complex fluid dynamics. The same type of hydrodynamic forces that allow engine oil to build wedges and waves to reduce engine wear, can delay brake application in modern electrohydraulic brake systems. Controlling and stopping a sliding, spinning, or otherwise out-of-control vehicle is at least partially determined by how quickly those brakes can be applied and released. Faster response times require lower viscosity fluids. Thicker fluid slows the brake application and release.

Brake fluid and engine oil kinematic viscosity are typically measured in centistokes (square centimeters per second). DOT 4 brake fluid viscosity can be up to 1,800 centistokes at -40 degrees C (cSt@-40 degrees C). ISO 4925 Class 4 is very similar but requires a reduced viscosity of 1,500@ -40 degrees C. Based on past marketing claims for engine oil, we should expect some ISO 4925 Class 4 fluids to be labeled "low viscosity." ISO 4925 Class 6 is the thinnest brake fluid at 750 cST @ -40 degrees C. When a Class 6 fluid is specified, the marketing claim of DOT 4 "low viscosity" should not be assumed to be sufficient.

Key Facts about fluid viscosity

- Kinematic viscosity is typically measured in centistokes (cSt) at 100oC.
- DOT 4 fluids are the thickest brake fluid at 1,800 cSt.
- ISO 4925 Class 6 & Class 7 fluids are the THINNEST brake fluids at 750 cSt.
- Thinner fluid is required for faster ABS & ESC response time.

The Department of Transportation (DOT) creates generic brake fluid standards based on Society of Automotive Engineers (SAE) and Federal Motor Vehicle Safety Standard (FMVSS) #116. These basic DOT standards are well known to most North American technicians.

Many of the cars sold in America since 2004 require a brake fluid material standard that includes ISO 4925 Class 6 requirements. These are often labeled "DOT 4-Class 6" or "DOT 4 - low viscosity". Unfortunately, many technicians focus on the DOT 4 requirement instead of the more stringent Class 6 requirement. Any Class 6 or Class 7 fluid also meets DOT 4 requirements. But most DOT 4 fluids do not meet class 6 or class 7 requirements.

EXAMPLE: Ford requires WSS-M6C65-A2 approved "Mo-

torcraft DOT 4 LV" fluid, or similar WSS-M6C65-A2 approved brake fluid. The Ford WSS-M6C65-A2 standard includes the much more stringent ISO 4925 Class 6 (DOT 6) viscosity requirements.

EXAMPLE: VW/Audi Brake Fluid is labeled "DOT 4 Class 6". DOT 4 is not sufficient for most VW Group vehicles built since 2006. VW required Material Standards "TL 766 Z" and "501 14" both include ISO 4925 Class 6 standards in addition to DOT 4.

Marketing terms such as "super," "low viscosity (LV)," "electronic stability control (ESC)," "electronic stability program (ESP)," and "plus, (+)" are not well defined or enforceable. Always refer to OEM material standards and their associated DOT standards and ISO 4925 standards. DOT has not yet evaluated or approved any DOT 6. So, any claims of DOT 6 or DOT 7 approval are not credible. Failure to use Class 6 (DOT 6), Class 7 (DOT 7) or DOT 5.1 brake fluids, as required by many vehicle manufacturers, will potentially compromise braking performance.

Braking requires tire traction

Maximum braking performance is achieved by maintaining maximum tire traction. On typical road surfaces, maximum traction is usually achieved as the tire is slipping between 5 and 20 percent, depending on the road surface. ABS repeatedly applies and releases brakes when attempting to maintain this maximum traction. Brake fluid viscosity ultimately determines how quickly the brakes can be applied and released. Faster cycling capability can improve the performance of both braking and stability control.

If you ignore the Material Standard and focus on the "DOT 4" part of "DOT 4-Class 6", you are making a big mistake. DOT 4 will appear to work normally, and no trouble codes will be set. You probably won't notice any difference until you need that ABS or ESC system to help avoid a terrible accident on a cold, ice-covered road. That's when the system will fail! Low temperatures are when the fluid will be the thickest, and slowest!

Think of the liability that will fall on your shop when it is discovered that the fluid you installed is incorrect and caused a fatal accident! In one court case (Shank vs Charger), a motorist experienced problems with their braking system approximately six months after a quick lube shop serviced the vehicle. It was shown that a small amount of the wrong fluid had been added by the quick lube shop. There was no collision and no injuries. The only damage was to the vehicle's braking system. The court awarded $2,500 in damages and an additional $2,468 in attorney fees.

THIS CAP MAY INDICATE that DOT 4 brake fluid is required. However, the proper materials standard of DOT 4 fluid must also be met. If not, braking performance may be compromised.

TABLE #2

The OEM "DOT 4" fluids in the chart below are NOT just DOT4. They are also required to meet much more stringent standards.

	Ford	Ford	GM	VAG	BMW	Jaguar	Volvo	Toyota
OEM Product Name	Motorcraft DOT 5.1 Motor Vehicle Brake Fluid	Motorcraft DOT 4LV High Performance Motor Vehicle Brake Fluid	AC Delco GMW Brake and Clutch Fluid	VW/Audi DOT 4 Class 6 Brake Fluid	BMW DOT 4 Brake Fluid	Jaguar Brake Fluid	Volvo Brake Fluid	Toyota DOT 4 Class 6 Brake Fluid
Part Number	Motorcraft PM-21	Motorcraft PM-20	GM 19299570, AC Delco 10-4086	VAG B0007501LDSP	N/A	Jaguar C2D34402	Volvo 31400206	N/A (2020+ J29/DB GR Supra)
Required Material Standards	WSS-M6C65-A3	WSS-M6C65-A2	GMW 3356	TL 766 Z, or 501 14	BMW QV 34 001	N/A	N/A	BMW QV 34 001
Equivalent ISO Standards	**ISO 4925 Class 5-1**	**ISO 4925 Class 6**	**ISO 4925 Class 6**	**ISO 4925 Class 6**	**ISO 4925 Class 6**	**ISO 4925 Class 6**	**Dot 5.1 & ISO 4925 Class 6**	**ISO 4925 Class 6**

Substituting DOT 4 fluid for Class 6 fluid limits the response time of ABS and stability control systems. This compromises safety and creates civil and criminal liability for both the shop and the technician.

THIS CHART INDICATES VOLVO requires DOT 4, DOT 5.1, and ISO 4925 Class 6 for their newest vehicles. This is not an option but an indication that the brake fluid to be installed must meet all three specifications.

Manufacturers' standards are chosen for a reason

Most manufacturers have their own proprietary "material standards." Some material standards duplicate DOT or ISO standards. In many cases, they are so close that the generic DOT or ISO standard they can be substituted for the proprietary standard. But many material standards are far more stringent than any current DOT standard. Technicians must focus on the manufacturer's material standard, not the generic DOT Standard.

As the attached chart **(Table #2)** shows, some manufacturers (Volvo, Jaguar, etc.) use ISO and/or DOT standards instead of proprietary material standards. Volvo requires DOT 4, DOT 5.1 and ISO 4925 Class 6 approval for their newest cars. That does not mean you can choose which spec you meet. It means you must use a fluid that meets all three specifications! The chart also shows that DOT 4 is not sufficient for most modern Ford and GM vehicles. Ford WSS-M6C65-A2 and

GMW 3356 material standards both include ISO 4925 Class 6 requirements.

Fluids, in general (especially brake fluids), have become complex enough that our industry may require more training in fluid dynamics and critical reading skills. Far too many technicians fail to read service information comprehensively. Some lack the critical reading skills to accurately interpret the more complicated service information for some new vehicles. We must have the ability (and patience) to read carefully, interpret carefully, and research any technology we don't yet fully understand.

All the different 'flavors' of brake fluid

DOT 3 (Similar to ISO 4925 Class 3):
DOT 3 is the lowest boiling point and among the highest viscosity of all currently common brake fluids. It should not be substituted for other brake fluids.

DOT 4 Brake Fluid (Similar to ISO 4925 Class 4):
DOT 4 has the highest maximum allowable viscosity of any brake fluid and therefore has the slowest response time. Even DOT 3 and ISO 4924 Class 4 have slightly lower maximum allowable viscosity than DOT 4. But most DOT 4 products are formulated to also meet DOT 3 viscosity requirements. DOT 4 is glycol-based and is often formulated with slightly lower viscosity so that it can be backward-compatible with DOT 3.

DOT 5.1 Brake Fluid (similar to ISO 4925 Class 5-1):
The dual specifications DOT 5.1 and ISO 4925 Class 5-1 have the HIGHEST boiling point. They also have significantly lower maximum allowable viscosity than DOT 3 or 4. DOT 5.1 is glycol-based and backward-compatible to DOT 3 & DOT 4. WARNING: DOT 5 shares the same boiling point as DOT 5.1 and Class 5-1 but is silicone-based and cannot be mixed with any other fluid or substituted for any other fluid.

Class 6 Brake Fluid (AKA DOT 6):
ISO 4925 Class 6 (DOT 6) brake fluid has the LOWEST viscosity and is required in many modern automobiles. Class 6 is glycol-based and backward-compatible to DOT 3, DOT 4 & DOT 5.1.

Class 7 Brake Fluid (AKA DOT 7):
ISO 4925 Class 7 (DOT 7) brake fluid has the LOWEST viscosity and the HIGHEST boiling point. Class 7 matches the boiling point of DOT 5.1 and the low viscosity of Class 6. Class 7 is glycol-based and backward-compatible to DOT 3, DOT 4, DOT 5.1 & Class 6.

Obsolete and Non-Compatible Fluids:
DOT 1 and 2, ISO 4925 Class 1 and 2 are obsolete fluids. DOT 5 (usually red/purple) is silicone-based. LHM (usually green) is mineral oil-based. None of these should ever be mixed with or substituted for any other fluid.

WARNING: When an OEM mentions multiple standards, make certain you meet ALL REQUIRED standards. Modern technicians MUST have reasonable "technical reading skills." The Ford WSS-M6C65-A2 material standard is an important example. Far too many technicians read the Ford brake fluid requirements in ALLDATA, Mitchell, or Ford service information and misinterpret the statement. The Ford Material standard is the requirement, not DOT 4!

To "brake" it down further (pardon the pun), there are a variety of brake fluid specifications that are designed to meet the needs of the systems they are being used in. Paying mind to not only the DOT rating (and/or ISO classification) but also to what each manufacturer requires for their materials standards will ensure safe and proper brake hydraulic system performance.

KEVIN MCCARTNEY serves the automotive service/repair industry as a trainer, consultant, and writer. Connect with him on LinkedIn at *linkedin.com/in/kevin-mccartney-526220a/*.

PROPER TIRE HEALTH ANALYSIS

WHEN IT COMES TO TIRES, SAFETY SHOULD ALWAYS BE THE NUMBER-ONE PRIORITY. HAVING SUFFICIENT TREAD DEPTH IS ONLY THE MINIMUM CRITERION FOR SAFETY; THERE IS MORE TO IT THAN THAT.

BY BRANDON STECKLER // Technical Editor

Being in the business of supplying tire service to our customers has always been a profitable venture. Although the margins in tire sales are slim, tire replacement service opens many doors of opportunity for us as technicians and shop owners alike. A simple "flat repair" can allow us to evaluate all the tires' conditions and perhaps even the opportunity to evaluate the vehicle's wheel alignment. Of course, that could lead to significant chassis/steering/suspension repairs and adjustments. The benefits are threefold; a safe vehicle for the motoring public, revenue for the shop, and a fatter payout for the technician.

1 **THE DISTANCE TO BETWEEN** the top of the penny and Abe's head is approximately 2/32". If the penny is placed within tread (as displayed in the picture) and Abe's head is visible, the tread is too low for safe operation and the tire should be replaced.

Gauging tire life

Most of the time, the need for tire replacement is justified by the depth of the remaining tread. The reason should be clear. The surface of the tires provides that critical bond between your vehicle and the road. Because we drive upon a variety of road surfaces and in different weather conditions, tread health and depth are critical components of tire safety, not only for acceleration and handling but also for braking performance. With that beneficial aspect of traction comes the wear or sacrifice of that same surface. Once that tread is no longer sufficient, the traction that was once there will disappear along with it.

Even if only one tire is significantly worn (compared to the others) it's rare that only that tire is replaced. It's common to replace them in pairs (at minimum) or as a set of four. Hence the reason tires can be a moneymaker.

Measuring the tire tread to determine the remaining usable life is accomplished in a handful of different

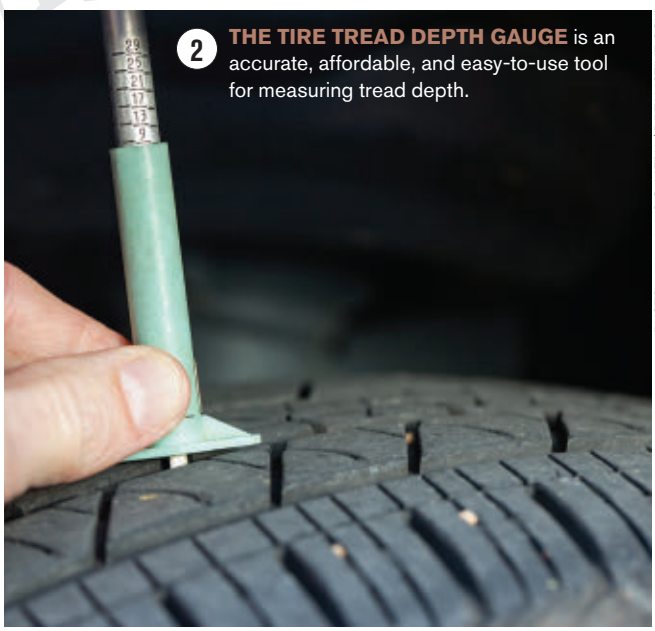
ways. For years, customers have been instructed to use a penny; inserted head-first, if Abe Lincoln's head is visible, it's time for a replacement, as this would indicate the tread depth is less than 2/32" **(Figure 1)**.

Other methods include tools that will not infer tread depth but display it (in millimeters or fractions of an inch). The tread depth gauge is available to the public, is very affordable, and will almost always be found in any technician's toolbox, regardless of his or her area of expertise **(Figure 2)**. But even without additional tools, the tires include wear indicator bars embedded in the tread to help in determining the need for replacement.

Analyzing the tread wear

Just as a doctor can analyze an X-ray (or better yet, a diagnostician analyzing a waveform), the goal is not only to recognize that wear has occurred but to determine the root cause of the wear. If we don't use this approach, we are doing our customers an injustice and are begging for a comeback. Just because a measurement above 2/32" makes the tire legally safe for driving, it does not make its performance optimal. Tires with lower remaining tread life are prime candidates for experiencing hydroplaning or loss of directional stability. The remaining tread exceeding 6/32" should provide significantly safe performance. However, between 5/32" and 6/32" should justify considering a replacement for vehicles operating in slicker conditions like snow. Tires between 4/32" and 5/32" yield a reason for replacement if operating in rainy conditions, as their ability to channel water away from the contact surface has been depleted. Tires between 3/32" and 4/32" have little useable and safe life left in them, and any less tread depth than that comes with a significant loss in performance in handling and braking in almost any condition.

Everything from improper inflation to worn chassis/suspen-



2 **THE TIRE TREAD DEPTH GAUGE** is an accurate, affordable, and easy-to-use tool for measuring tread depth.

PHOTO 245825678 © CSMEDIA | DREAMSTIME.COM

PHOTO 218094652 © ZIGMUNDS DIZGALVIS DREAMSTIME.COM .JPG

3 **THE TIRES DOT NUMBER TELLS** not only its date of birth but also the tire size, manufacturer, and where it was made. This information can be of assistance when trying to determine if a recall is open for the tires as well.

sion components and wheel misalignment can and does contribute to tire wear. Again, fixing the root cause of the wear should be as important as the replacement of the tires themselves.

Times are a-changin'

As time goes on, safety standards have become more stringent across the board. This is evident with the rise of Advanced Driver Assist Systems (ADAS). If the customer didn't demand all the creature-comfort bells and whistles, the government and the Society of Automotive Engineers sure have.

This tightening of the safety standards is prevalent in the tire industry as well. We as technicians (well, "shops") must register the tires using the number issued to each tire by the Department of Transportation (DOT Number). This number is found on the sidewall of each tire **(Figure 3)**.

The DOT number is comprised of eight to 13 letters and/or numbers that identify where the tire was manufactured, tire size, and the manufacturer's code, along with the week and year the tire was manufactured. This information is required to be registered. The reason this becomes so important to us is it provides a means to track the tire for age/years in use, and if any safety recalls were issued concerning the safety of that particular tire.

It goes without saying that if you don't "cover your tail," you are bound to get bitten. Documentation becomes ever more important today. We are tasked with accurately noting the tires' DOT number on the repair order, in the shop software, and getting it to the customer (for their records). And information can tend to get misconstrued with the more hands it passes through (we all remember the game "telephone" as kids).

A solution to all this could be as simple as the tool chosen. As I tend to mention in almost every class I conduct or diagnostic article I've written, having the appropriate tool to get the job done is only half the benefit. Being familiar with what that tool can do for you is what is required rap-

4

THE AUTEL TBE200 is an all-encompassing tool for measuring both brake rotor condition and tire tread depth. It can store the captured measurements and take photos that can uploaded to a printable comprehensive health report. The tool is cloud-based and can access the outstanding safety recalls that correlate to the DOT numbers on the tire.

idly get your return on investment.

For instance, Autel offers the TBE200 which is a combination of a tire tread depth and brake rotor condition analyzer. Although I'm not one to commercialize any one tool I will say that I'm impressed with the features it boasts because it solves all the challenges mentioned above **(Figure 4)**.

On top of being accurate to within .1mm, the TBE200 tread depth reader provides wear analysis and displays the measurement data curves in real-time, along with service advice for the customer. It also features a means to scan and store the tire DOT number. This device is web-based, so as it is reading the number it can alert you if any recalls on the tire exist (remember the "cover your tail" factor?). During analysis, and if damage to the tire is noticed, pictures can be taken and saved with the tool. But in my opinion, that is not quite the best part.

Optionally, any information that the tool captures can be uploaded to the cloud and anything we would tend to simply document on the repair order can now also be shared both with the shop's management software and the customer.

This tool can work in tandem with the TPMS tools also offered by Autel (their ITS600). With this combination, all the captured information can be documented in a comprehensive vehicle health report, with the shop information already populating the report. Of course, it allows for printing and physically handing the report to the customer to aid in conversation and education.

Now, other tools on the market may provide some of these same features. The key difference, I think, is having all the features within the same tools that are attractive. But whether or not you are using these tools to aid in efficiency, you certainly don't need them. They simply make the job faster and easier. Safety should be your number one priority; accuracy is a close second priority. But, in combination with efficiency, it's a win-win-win combination in my book.

Providing sound information to our customers allows them the opportunity to make sound decisions. Nobody typically likes to learn that they must spend some money, and they certainly don't care about how much you know until they know how much you care. Alerting them to upcoming investments in their vehicles to keep them safe shows how much you care; they really appreciate that.

BRANDON STECKLER is the technical editor of *Motor Age* magazine. He holds multiple ASE certifications. He is an active instructor and provides telephone and live technical support, as well as private training, for technicians all across the world.

PROVIDES DETAILED SCAN REPORTS INCLUDING TREAD DEPTH MEASUREMENT

The Autel MaxiTPMS ITS600 Intelligent Tire Service and Diagnostic Tablet is a wireless, touchscreen Android-based tablet that offers complete TPMS diagnostics and service functions. The tablet features a 5.5" color display and Bluetooth VCI. Compatible with U.S, Asian, and European TPMS-equipped vehicles, the ITS600 offers an enhanced TPMS status screen, VINscan for rapid vehicle identification, four MX-Sensor programming options, OBD-II relearn functionality, and onscreen relearn instructions for all vehicles. The ITS600 can activate, read, and relearn all known sensors, and perform TPMS system diagnostics and four common maintenance services. The ITS600 is compatible with TBE200/TBE100 Tire Tread and Brake Disc Wear Analysis tool (sold separately).

VEHICLESERVICEPROS.COM/21164536

SECURELY SUPPORTS 2,400 LBS

The Bendpak EV2400SL is an EV battery pack and powertrain lifting system. The compact and portable unit rides on proprietary zero-throw casters on all four corners that provide low rolling resistance and unparalleled maneuverability around the shop. The EV2400SL elevates to more than 6' in less than 20 seconds. It supports 2,400 lbs on its oversized 40" by 60" cushioned rubber platform. Adjustable screw jacks on each corner provide effortless pitch and roll adjustments for more precise alignment of high-voltage batteries, engine and drivetrain assemblies, fuel tanks, and more.

VEHICLESERVICEPROS.COM/21270584

DO ALL TYPES OF DIAGNOSTIC LEAK DETECTION WITH A SINGLE MACHINE

The Redline Detection Dual-purpose Diagnostic Leak Locator No. 95-0130, can diagnose all leaks, including low pressure for traditional vehicle EVAP/general repair and variable high pressure for turbo, diesel and heavy duty testing. Its design allows even relatively inexperienced technicians to quickly locate hard-to-find leaks and confirm that the vehicle is fixed correctly the first time. The ability to switch from low-pressure to high-pressure testing for different applications saves valuable service hours. It serves as a valuable, economical tool for any technician who seeks to increase shop efficiency.

VEHICLESERVICEPROS.COM/21286346

TECHNICALLY REFINED PARTS WITH A 4-YEAR WARRANTY

Meyle offers three product lines — Meyle-HD, Meyle-PD and Meyle-Original — with over 24,000 automotive spare parts and matching Meyle-Kits, which contain all the components needed for installation and removal. The German brand offers high-quality parts for chassis and steering, rubber-metal parts, brakes, damping, cooling, filters, drive parts, and electronics and sensors.

VEHICLESERVICEPROS.COM/21286484

CAPABLE OF 45 JUMP STARTS ON A SINGLE CHARGE

The TOPDON JumpSurge3000 is a 3,000 peak-amp jumpstarting tool and power bank for vehicles on and off the road. The device supports vehicles with 12V batteries on up to 9L gas engines and 7L diesel engines. Capable of 45 jump starts on a single charge, the JS3000 also has a boost function for difficult jumps and provides fast charging for devices such as laptops, cell phones, and more. Additionally, it features a 400 lm LED flashlight, sturdy outer housing that resists water, dust, and wear, as well as a Stop Spark Sensor that suspends its use after too many jumps in a 10-minute period.

VEHICLESERVICEPROS.COM/21262796

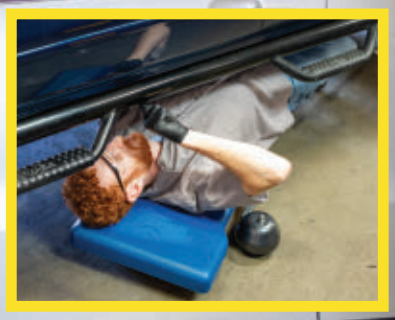
A PERMANENTLY ELASTIC, UNIVERSAL SILICONE RTV

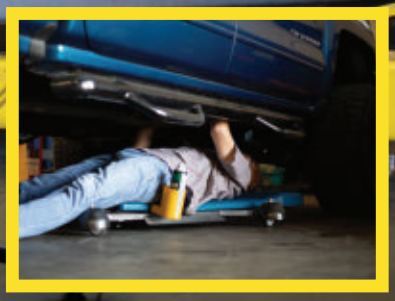
Victor Reinz Reinzosil is a permanently elastic, universal silicone sealing compound with excellent resistance to fluids and extreme temperatures. Its durability, flexibility, and versatility make it a favorite among import car repair specialists. Reinzosil is an RTV sealant of choice in Europe. Now, Victor Reinz brings this in-demand product to the North American aftermarket.

VEHICLESERVICEPROS.COM/21286339

THE PERFECT HOLIDAY GIFT

WORK MEETS COMFORT





ROLLING CREEPER SEAT CONVERTS FROM HIGH TO LOW

UP TO 6 LOCKING HEIGHTS

The **ergochair™** is the adjustable height rolling work seat which will make performing awkward work tasks ergonomically easier and safer. This comfortable creeper seat offers a full range of mobility, increased productivity, and reduced fatigue. To Learn more visit **bendpak.com/ergochair**

TRANSFORMS COMFORTABLY FROM CREEPER TO UPRIGHT SEAT

1-800-253-2363 • BENDPAK.COM

ergochair™

HAS A TEST RANGE OF 1MA TO 60A DC/AC

The High Accuracy Low Current Clamp Meter, No. 683, from Electronic Specialties was developed with new circuitry designed to maximize low current accuracy and zero stability. The clamp is able to measure parasitic drains accurately, efficiently, and with dependable/repeatable readings. It features a 1mA low reading resolution and can read up to 60A. The 16mm x 18mm clamp opening is large enough to clamp over most negative battery cables. The 683 reads both DC and AC current, and it detects the current automatically. The clamp can also record up to 99 records for recall later. Unit comes with zippered storage case, manual, and 9V battery.

VEHICLESERVICEPROS.COM/21277748

AUTOMATICALLY SHUTS OFF TO PREVENT OVERINFLATION

The Milwaukee Tool M18 Inflator is an 18V cordless tire inflator designed to meet the needs for transportation maintenance professionals by providing ideal performance, versatility, and the durability to survive demanding jobsites. With the 150 psi max capability, users can fill tires twice as fast. Additionally, the inflator is equipped with TrueFill auto shut-off technology that has the accuracy to be set at a specific psi which will automatically shut off the tool to prevent overinflation. Coupled with the resistance to auto shop chemicals, the M18 Inflator solves common user frustrations as a durable, versatile solution.

VEHICLESERVICEPROS.COM/21253916

COMPLETE ELECTRIFICATION INTEGRATION INTO THE DRIVE WHEELS

The E-wheel drive from Schaeffler provides complete integration of an electric motor, power electronics, control system, and mechanical system (including the wheel bearing) into the drive wheels. Its packaging flexibility "allows new vehicle structures and interior concepts for the city-driven car of tomorrow," according to the company. Because each drive wheel is individually controllable, the design provides for increased maneuverability and agility due to torque-vectoring, and the design offers improved active safety due to expanded ESP/ABS functionality. Per axle, each E-wheel drive offers a continuous 1,000 Nm/50 kW (about 738 lb. ft./68 hp), with a peak of 1,600 Nm/85 kW.

VEHICLESERVICEPROS.COM/21286337

PROVIDES A UNIQUE MOBILITY SOLUTION

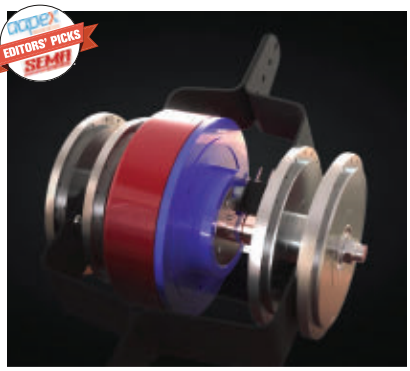
The EZ Roller-Spinner Spinning Hub is a universal wheel that provides a unique one-of-a-kind mobility solution for standard cars or electronic vehicles when the brakes freeze or the vehicle has no power. It is easy to use, bolts onto the vehicle's hub in minutes, and the disabled car can be pushed or pulled into the shop or onto a tow truck. Two universal wheels provide the solution to move most four, five, and six-lug vehicles and work on AWD, FWD and RWD vehicles. The hub replaces dollies or two-step spinning hubs and works outside on inclines, gravel, and uneven pavement. There are no extra parts required, and the EZ Roller-Spinner uses factory nuts and bolts.

VEHICLESERVICEPROS.COM/21286364

QUICKLY AND EASILY PURCHASE OR SELL OEM WHEELS

Featured in the New Products Showcase at the 2022 SEMA Show, RimText is a system shops can use to quickly and easily purchase OEM wheels or sell their take-offs. EveryRim.com remains an option. The company says the text system (951-RimText/951-746-8398) is faster and more accurate than any web site/ Simply click and send a pic of the required OEM wheel, with no part number or model and year needed. Shop personnel can sell take-offs with a pic of one wheel or a pile of wheels, and the company can take it from there. The ability to receive a timely reply can help a shop decide to keep and what to scrap.

VEHICLESERVICEPROS.COM/21286612



INCREASED ELECTRIC VEHICLE RANGE WITH THE ROADKIL 5000

GIG Performance's Roadkil 5000 is a regenerative power system designed to extend an electric vehicle's range. The Roadkil 5000 (name inspired by kilowatt, the electrical unit of measurement) directs energy to the electric motor and/or batteries in any vehicle—from semi-truck to ATV—over any terrain to extend battery life and provides greater performance in mileage and complements the standard EV. While the installation is different for every vehicle type, it works smoothly with each vehicle's unique suspension system, attaching wherever it can hook in. Users can also connect as many units as possible as there are axles. The Roadkil 5000 captures lost energy within the suspension system and redirects it back into the battery, dramatically increasing energy efficiency. In addition to power generation, the device also functions as a dynamic shock-absorbing system.

VEHICLESERVICEPROS.COM/21286400

GIVES TECHS A MORE HANDS-ON APPROACH

The Maverick Tire Changer from Hunter Engineering is a center-clamp tire changer that shares many features with Hunter's standard-setting Revolution tire changer, but gives technicians a more hands-on approach and freedom to adapt the process to their own precise needs. With its four-joystick layout, the Maverick provides tactile feedback with one-handed control. Its leverless head utilizes a Revolution-style tool and hook mechanism for maximum wheel protection, while automatically articulating to maintain ideal wheel alignment. A lifting ledge in the pusher foot saves additional time and effort. Additionally, it features HunterNet 2 connectivity, a compact size, and hydraulic cylinders that deliver force and precision over air cylinders.

VEHICLESERVICEPROS.COM/21287523

AD INDEX

THE TRAINER #131: TIRE INSPECTION IN A DIGITAL AGE

TIRE INSPECTION IS A FUNDAMENTAL CHECK THAT SHOULD BE PERFORMED ON EVERY CUSTOMER'S CAR.

PETE MEIER // Creative Director, Technical

Performing a visual safety inspection is the very least you should do for every customer when he or she brings his or her vehicle in for service. An inspection of the tires and tire pressure is an important part of that inspection.

Consider that the contact patch on the tire is roughly the size of your hand, and every driver input – acceleration, turning and braking – is dependent on those contact patches staying in contact with the road! Tires that are worn or improperly inflated have a direct impact on the tire's ability to do just that, and there is no excuse for sending a customer out the door with a tire problem that you haven't either corrected or advised them of.

Today, technology demands a more accurate and professional approach. Using the Autel ITS600 and the TBE200 together makes the process easy and more complete.

Raise the vehicle up to a comfortable working height and begin the inspection. The first step is to test the sensors. Look for two things: the condition and accuracy of the sensors. Compare the sensor pressure reading to the actual tire pressure using a digital tire pressure gauge.

Any sensors that are not fully functional — that is, not reporting, reporting inaccurately, or showing a weak battery, — should be replaced. Any signs of corrosion inside the Schrader valve are another reason for replacement.

If you find a tire that is low, especially if it is lower than the others, rotate the tire slowly and look for anything that has punctured the tire, and recommend the appropriate repair.

I'll use the TBE200 to inspect the tires for wear. The laser measurement capability of the TBE200 results in an accuracy of 0.1mm – better than an old manual depth gauge – and helps paint a picture of the wear pattern. The tool integrates with the ITS600 and allows you to prepare a detailed report for your customer and, of course, for your shop records.

To see these tools in action and more, watch this month's edition of The Trainer!

ACCELERATE

A MOTOR AGE TRAINING EVENT

MOTOR AGE TRAINING | PTEN | MOTOR AGE | ABRN | VEHICLESERVICEPROS.com

SCOTT BROWN

Session: ENGINE CONTROLLER CALIBRATIONS: Developing New Perspectives for Drivability Technicians

PETE MEIER

Session: ELECTRICAL CHALLENGES: Three Steps to Successful Electrical Troubleshooting

BRANDON STECKLER

Session: SCAN TOOL ANALYSIS 101: Gaining Diagnostic Direction From The Driver's Seat

G. JERRY TRUGLIA

Session: HYBRIDS & EVS: Understanding and Diagnosing Hybrid / Electric Vehicles

UNLIMITED ON-DEMAND ACCESS UNTIL JANUARY 31, 2023

Recorded Live in October in Rosemont, IL, the complete ACCELERATE training event (8 HOURS OF TRAINING) is now available On-Demand. Don't miss these educational sessions. Shop professionals, educators, and automotive repair students interested in upping their game when it comes to vehicle repair diagnostics, solving electrical issues and dealing with hybrid and electric vehicle repairs will want to take advantage of this virtual opportunity. Our technical experts are nationally recognized as some of the best in the business. Register today and get immediate access to four technical courses and learn about new products and repair solutions from leading vendors offering tools, shop management assistance and vehicle repair parts and services.

PREMIER SPONSOR: AUTEL

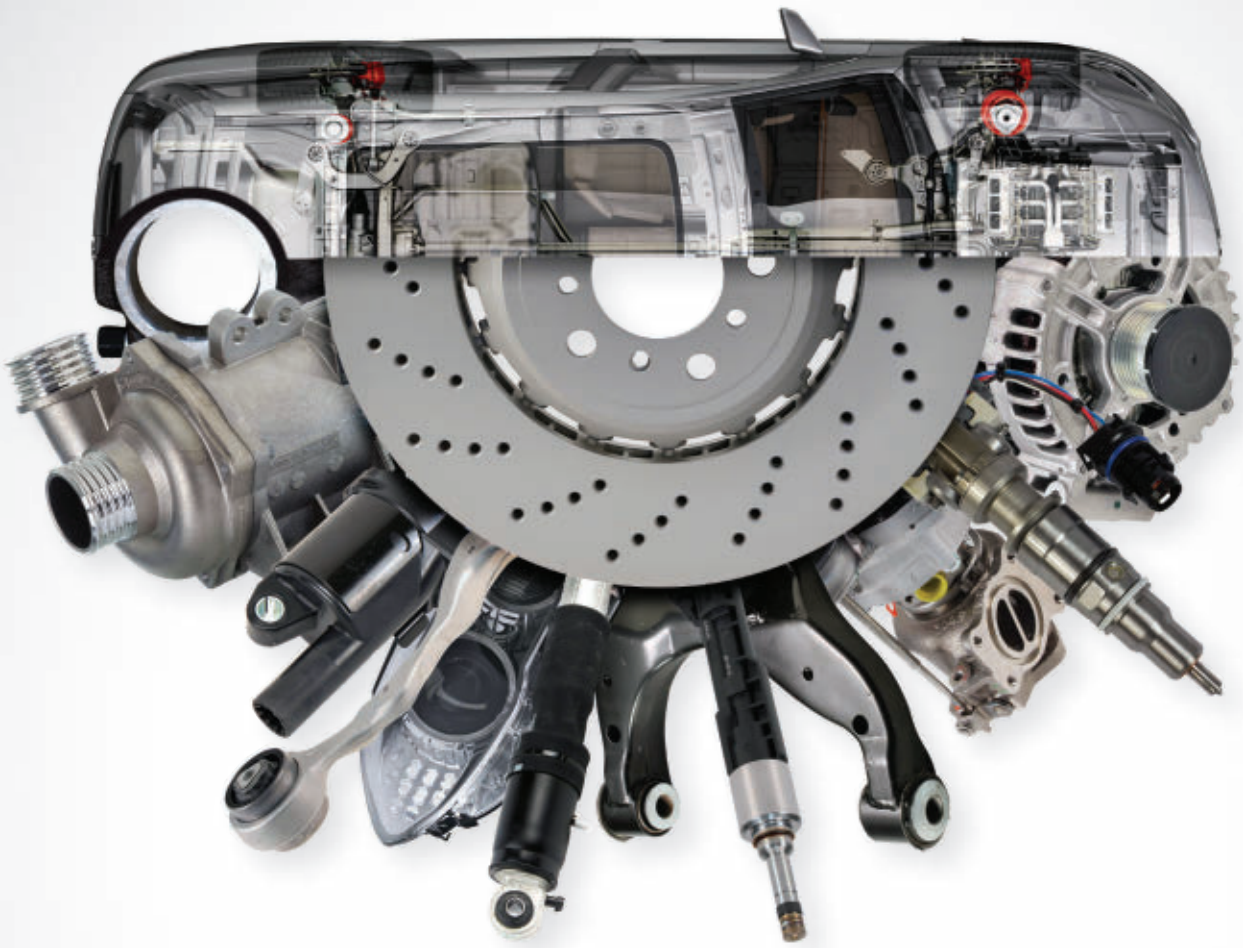
SIGNATURE SPONSOR: Milwaukee

PRIMARY SPONSORS: REPAIR PAL, AutoLeap

WWW.ACCELERATE-CONFERENCE.COM

YOU'RE COVERED

Worldpac stocks OEM parts for every situation.



WORLDPAC®

worldpac.com | worldpac.ca

Access quality parts, technical training and business solutions all in one place.

DIAGNOSTIC PROCESS

DECEMBER **2022**

GUIDE TO

DIAGNOSTIC PROCESS AND TOOLS

ADAS, FAULT CODES, HYBRID/EV, EDUCATION, AND PRODUCTS

CAT CHASE
Chasing catalytic converter fault codes
Page 10

LEARNING TOOLS
Becoming a valuable technician takes tools, time, and comprehension
Page 16

BROUGHT TO YOU BY

PROFESSIONAL DISTRIBUTOR · PTEN PROFESSIONAL TOOL & EQUIPMENT NEWS · MOTOR AGE · VEHICLE SERVICE PROS.com

SPONSORED BY:

AUTEL · BOSCH · CanDo · HUNTER Engineering Company · LAUNCH TECH USA CREATE · CHANGE · MATCO TOOLS · Snap-on

MATCO TOOLS

A SCAN TOOL FOR EVERY TECH!

MAXIMUS 4.0

THE MOST POWERFUL MEMBER OF THE DIAGNOSTICS FAMILY.

Accept more jobs with the all-in-one scan tool available for passenger and heavy-duty vehicles.

NEW! MAXFLEXPRO

FASTER, TOUGHER, SMARTER.

Expandable coverage to custom-fit your diagnostic needs.

Included with fully-loaded coverage.

MAXLITEA

MINI AND MIGHTY DIAGNOSTICS.

Find more than just an average code at an affordable price.

Talk to your Matco Tools Distributor or visit www.matcotools.com for more information.

For more information visit VehicleServicePros.com/10095267

ONLINE EXCLUSIVES

PRODUCTS

Bluetooth-enabled OBD-II scanning solution
VehicleServicePros.com/21285063

BLOG

Maximizing diagnostic tool features
VehicleServicePros.com/21265058

VIDEO

Mastering vehicle diagnosis with Brandon Steckler: Part 1
VehicleServicePros.com/21277946

NEWS

ASE introduces new ADAS Specialist Certification
VehicleServicePros.com/21285039

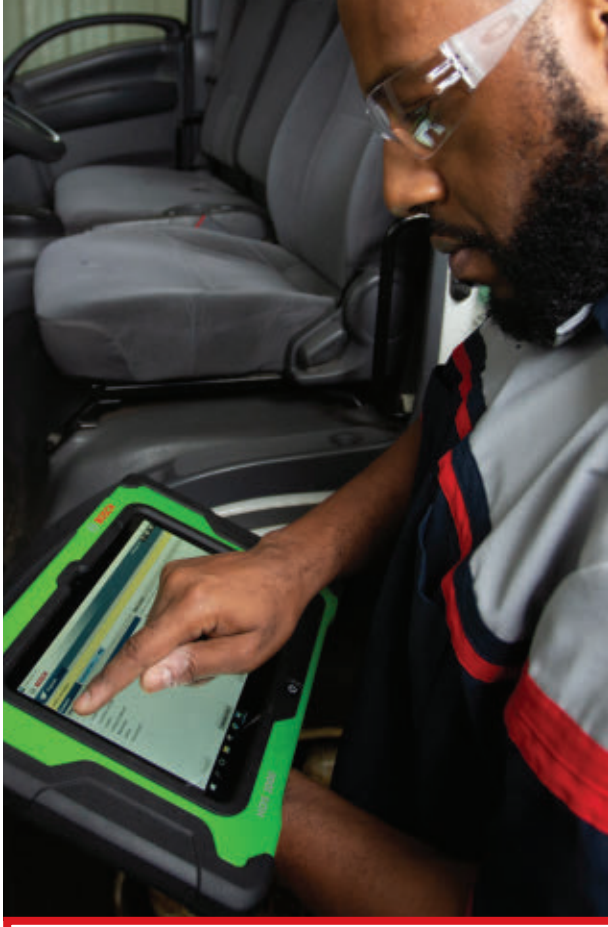
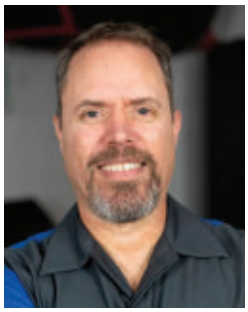


Photo from Bosch

CONTENTS

DECEMBER 2022



Diagnosing Progress

We are at the cusp of a new era in diagnostics and computer control.

By Brendan Baker, Editor
BBaker@EndeavorB2B.com

In the early days of EFI, and OBD-I, there were no real standards for getting data from the ECU. My brother and I raced a Honda Prelude in the IMSA Firehawk Series for showroom-stock cars that were modified for safety and that's about it. You weren't allowed to make performance modifications outside of the stock specs. But some teams figured out how to skirt the rules and modified the baseline ECU maps by having them reflashed to specific parameters such as removing the rev limiter or advancing the timing for a certain rpm range.

The GM cars that raced in the series had a distinct advantage because they were equipped to connect to a laptop through the ALDL port (the DLC before OBD–II). This allowed teams to make adjustments at the racetrack with a few taps on the keyboard; it was mind–boggling at the time. Honda teams banded together to swap ECUs as some were reflashed and worked better than others. However, we weren't able to change anything on the fly like GM teams.

My dad, who began racing in the mid–'60s before I was born, was from a different era. In his day, all of the adjustments were mechanical. Need more fuel? Change the jetting and read the weather to get the right air/fuel ratio. You can feel it in your hands. You'd give it a tune–up, as they do in drag racing. But my dad thought that the new electronic code readers and scan tools were like a genie in a box that fixed everything. Not quite. At that time, scan tools were in their infancy and mostly just to read the emissions codes and little else.

Baker Motorsports - IMSA Firehawk

Today, the idea of connecting a bi–directional scan tool to diagnose a vehicle and make the repair is the norm. Nearly every shop has a diagnostician on staff to troubleshoot and decode all of the data that is available to technicians. As we move further into what is ostensibly OBD–III, technicians, shop owners, and service advisors are going to be dealing with more data than ever. But data is only good when you know how to use it.

Next–level diagnostic tools and even connected machines like tire changers, inspection tools and brake lathes can help shop owners deliver higher profits and ROI. Techs can connect remotely to customers' vehicles to do an initial diagnosis before it arrives in the shop. And EVs are starting to creep into service bays across the country. It's as exciting as it is trepidatious.

There is a lot of opportunity for technicians and shop owners alike, but there are many challenges ahead. The technician shortage is real and appears to be getting worse. There are more cars and fewer shops doing the work. We are also seeing a changing of the guard in shops as many owners are at or near retirement.

Yes, the tools today are amazing and complex and require more training. ADAS is going to be mandated on all new cars soon. So, shops must be prepared to invest in the next level of equipment and tooling, but not everyone will make that leap of faith.

When you need $30,000 worth of ADAS equipment to change a windshield or repair a bumper, that tells you what is ahead for the industry. ADAS is somewhat a precursor to EVs and autonomous vehicles. There are far more sensors in vehicles today than a decade ago, and it's only going to increase in the years ahead.

My dad had the right idea about what a scan tool should do, but he was a little ahead of his time. We've certainly come a long way since the '90s.

LEVEL UP

You need to manage your diagnostics workflow from start to finish. So you need the most advanced information-driven scan and scope device in the industry, with the storage, processing and communications capabilities to get you through every step—designed and built specifically for the automotive industry by a company you're absolutely sure you can trust.

Driven by Fast-Track® Intelligent Diagnostics, the **ZEUS+™** provides you with the information you need to diagnose, repair and manage that issue—simplifying your workflow and increasing your efficiency on every job.

It's the only tool on the market that can do that.
All to help you level up your game.

snapon.com/zeusplus

Fast-Track® Intelligent Diagnostics.
Available on the APOLLO,™ TRITON™ and ZEUS.™

GET TO KNOW THE NEW ZEUS+™

Scan here to see it in action

Snap-on

Smarter. Faster. Fixed.

For more information visit VehicleServicePros.com/10094646

Common diagnostics and trends in hybrid and electric vehicles

Attendees of ASE's "NAPA - Hybrid and Electric Vehicle Update" webinar learned about high-voltage tools, trends, and common diagnostic issues.

By Kayla Oschmann

What we will see in vehicles 14 to 20 years from now will be completely different than what we are seeing now. That is what technicians and shop owners heard during a National Institute for Automotive Service Excellence (ASE) webinar.

"Technicians need to be up to date and onboard to work on electric vehicles (EVs)," said Jason Gloria, ASE Master Technician and NAPA Autotech Instructor. "Electric vehicles are our future, and they're not going away."

Gloria hosted ASE's webinar entitled "NAPA – Hybrid and Electric Vehicle Update" and identified several key topics for techs and shop owners to beware of when working on hybrid and electric vehicles.

Photo Courtesy of NAPA

SAFETY FIRST

Although manufacturers have built-in safety features within the high-voltage system, technicians still need to take the right steps to remain safe.

First and foremost is using the right tools. Special tools include a CAT III meter and leads as well as high-voltage rubber gloves and protective outer leather gloves. It's important to self-check the rubber gloves before every use. To do so, Gloria recommends filling the gloves with air, then roll up the cuffs to check for leaks.

Secondly, when working on EVs, one must first disable the high-voltage system. Every EV will have service disconnects. When a battery service disconnect is pulled out, a sensor will shut down the relays that connect the battery to the vehicle, disconnecting the power from the battery. Since there's still power in the battery, technicians still need to be careful when working.

It's only safe to probe the high voltage circuits after the service disconnect is opened, the capacitors have bled down, and DMM confirms 0V in the system, Gloria notes. Once confirmed, it's then safe to continue working with high-voltage gloves. Gloves are always needed when working inside the battery assembly until voltage levels are safe (12V or less).

THE FUTURE OF EVS

Tesla may not have come out with the first electric vehicle, but they are the ones who "made electric vehicles fun."

"It's the whole reason we are where we are," Gloria noted. "Without Tesla, all these manufacturers wouldn't be making electric vehicles."

The original Tesla, the Model S, was the one that made an impact (not the Roadster). The Model S consisted of 16 battery modules with each module holding 444 Panasonic 18,650 battery cells, similar to those found in flashlights.

Now, Tesla's Model Y is fitted with 4680 battery cells. They also created a tabless design to reduce electron flow distance – making it very efficient and eliminating thermal issues.

When it comes to Ford, the manufacturer took the No. 1 selling vehicle in the U.S. – the F-150 truck – and made it an all-electric truck. By going electric, they are taking people to the next step to adopting electric vehicles, Gloria said. It can do everything the gasoline-powered truck can do, plus it can power a house for three days from a full charge.

Most vehicle manufacturers have plans in effect to eliminate ICE vehicles as soon as 2035, if not earlier.

Same with state and federal legislation. There are already 12 states that have signed legislation in place to ban the sale of new ICE vehicles by 2035.

COMMON DIAGNOSTICS

Gloria shared three common EV diagnostic–related issues that he's come across.

For one, the warning lights on the dashboard of EVs are different. Gloria pointed out two: a wrench that means non–emissions fault and an orange triangle with an exclamation point, an ISO symbol for "master warning", that will appear when there's something going on with the high voltage system.

The high voltage battery is another common issue. Gloria said to check the battery by simply using a scan tool and looking to see which block's value is under. It's easy to do, yet many technicians don't do it at first.

The third most common issue are isolation faults where there's high voltage leaking somewhere in the system such as the battery, wiring, inverter, etc. Using an insulation tester, technicians can induce high voltage at very low amperage (once the battery is disconnected and verified to be at 0V). This allows hyper–accurate readings on all high–voltage circuit isolation conditions.

In conclusion, as obvious as it may seem, understanding the system you are working on and diagnosing is key. If you don't fully comprehend it all, simply ask or use your resources.

"Plot your diagnostic strategy," Gloria said. "Plan your work, work your plan."

Cooling High-Voltage Batteries

High-voltage batteries run best between 65 degrees F and 105 degrees F.

There are three ways to cool high voltage batteries –

1. Air cooled
2. Liquid cooled
3. Refrigerant cooled

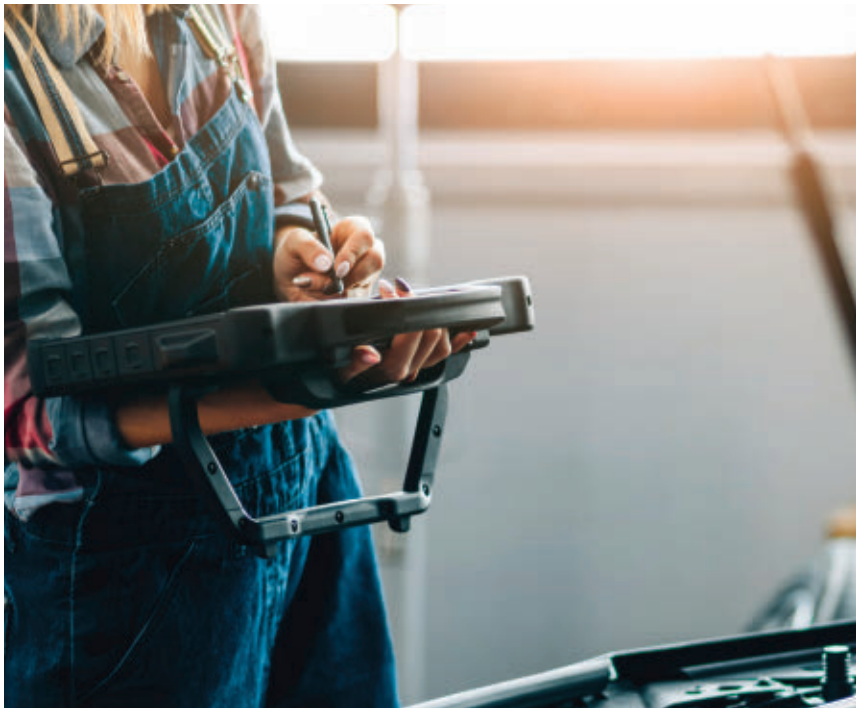
If air cooled, the cabin filter must be clean to ensure proper operation (prevent overheating of battery), Gloria noted.

Some manufacturers are using the AC system to cool the vehicle batteries. If this is the case, then AC is no longer an option, Gloria noted. He adds that in many scenarios at a shop, customers will decide not to spend $3,000 to fix an AC issue and will just "roll the windows down" instead. Now, technicians are going to have to explain to customers to rethink their decision because that $3,000 fix is now needed to cool a $10,000 battery.

Diagnosing faults on modern vehicles

The complexity of today's vehicles means technicians are flooded with additional data when diagnosing vehicle faults. Here are ways and tools to help diagnose these faults.

By Damien Coleman



Albertshakirov | Dreamstime.com

Motor vehicles have become increasingly more complex over the last two decades to meet ever-tightening emissions regulations, increased fuel economy requirements, and passenger comfort and safety.

This added complexity means technicians are flooded with additional data when diagnosing vehicle faults. Below is a table outlining the difference between a modern vehicle and a vehicle from 20 years ago; this is only a high-level example to illustrate the differences.

	VEHICLE PRE-2002	2022 VEHICLE
Number of Systems	≈6	25 - 40*
Engine Fault Codes	<50	>2000
Engine Data Parameters	<30	>100
Engine Special Functions	<3	>20

**Depending on options and trim level.*

FAULT CODES

However, with all the additional fault codes and data parameters, the technician is given more information that can help quickly and accurately diagnose any faults. For most fault codes, there are several possible sub-codes. These sub-codes give the technician an indication of the condition which caused the fault code to be stored. An example of this is shown below for turbocharger system fault codes:

- Turbocharger boost pressure – Negative deviation (under-boost)
- Turbocharger boost pressure – Positive deviation (over-boost)
- Turbocharger boost control circuit – Voltage high
- Turbocharger boost control circuit – Voltage low

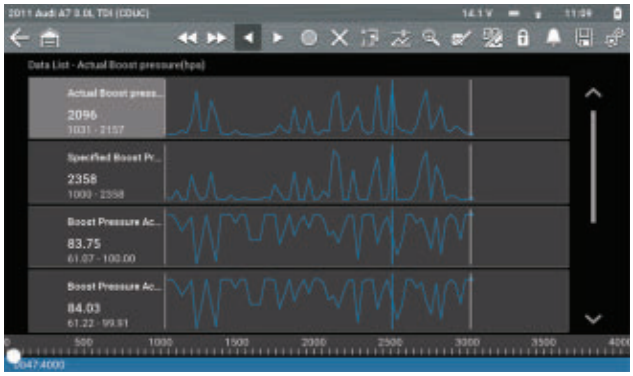
If a fault code won't clear with the ignition on and engine off, or the fault returns immediately once the ignition is switched on, the issue is most likely not mechanical in nature. An over-boost or under-boost fault will only be set after a test drive.

LIVE DATA

Many data lists will have two parameters for specific components or subsystems. In the screenshot (on page 9) we have 'actual' and 'specific' boost pressure. Comparing these data parameters is important to ensure the vehicle is operating under the conditions expected by the management system. There will be a certain amount of latency between these parameters, but the returned values should be similar.

Command and feedback are also evident here with the data parameters for the boost pressure actuator, activation value (%), boost pressure actuator, and feedback value (%). This shows the control from the engine control module acting on the turbocharger vane position actuator and the feedback from the turbocharger position sensor, which is inferred as a percentage.

- Parameter 1 – Actual boost pressure
- Parameter 2 – Specific boost pressure
- Parameter 3 – Boost pressure actuator, activation value (%)



Actual and specific boost pressures.

Yellow channel - turbocharger vane position sensor. Green channel - boost pressure sensor.

- Parameter 4 – Boost pressure actuator, feedback value (%)

SPECIAL FUNCTIONS

Many engine components must be "adapted" to the vehicle when replaced. Previously, components like turbocharger actuators were "plug and play." Now, these components must be matched to the system. This is a way of setting the base position for the actuator and position sensor and is used to detect possible faults or incorrect operation.

OSCILLOSCOPE TESTING

Another option to investigate the operation of a system is to use an oscilloscope. A scope provides a graphical representation of voltage over a particular time duration. The waveform below shows the output from the boost pressure sensor and the feedback from the turbocharger vane position sensor under wide open throttle operation on a road test.

Not only is the scope good for diagnosing faults and validating repairs, but it can also be used to give the technician an in-depth understanding of the operation of a complicated system.

Article provided by Snap-on Diagnostics

The real cause of P0420/P0430 DTCs

The 'Catalytic Converter Efficiency' codes might imply a failed converter, but odds are the ultimate fault lies somewhere else.

By Pete Meier

Common sources of air leaks into the exhaust system that can skew the ECM's tests include damaged flex pipes and stripped or damaged sensor threads.

The "Catalytic Converter Efficiency" Diagnostic Trouble Codes (DTCs) P0420 and P0430, are among the top 10 DTCs technicians face. And while the description might imply a failed converter, odds are the ultimate fault lies somewhere else.

The catalytic converter is the last stop for the exhaust gasses generated by the engine during operation. It is here that the last remaining pollutants are cleaned up before finally exiting the tailpipe.

There are three ways a converter can fail:

Overheated, melted, or a broken substrate in the converter. This is usually caused by any factor that affects the engine's air/fuel mixture and the resulting feed gasses being sent to the converter. Even slight variations will cause the converter temperature to rise significantly.

Converter poisoning: Converter poisoning means that the substrate has been coated by a foreign substance and is no longer exposed to the exhaust stream. Excessive oil consumption and coolant leaks past the intake or head gaskets are common contaminates, as is the improper use of certain sealants.

Structural damage: Structural damage can be physical damage like dents caused by road debris striking the housing, stripped oxygen sensor threads, thermal shock to the converter, and metal fatigue at mounting points or welds.

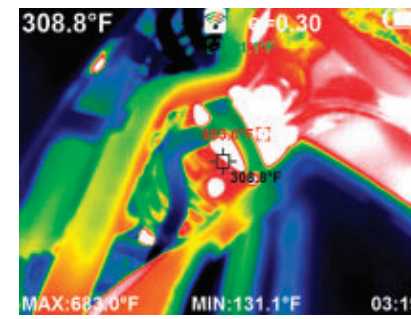
HOW TO TACKLE THESE DTCS

When tackling these DTCs, you must first determine if the converter has truly failed or not. You'll be surprised at how many P0420/P0430 codes are corrected without replacing the cat!

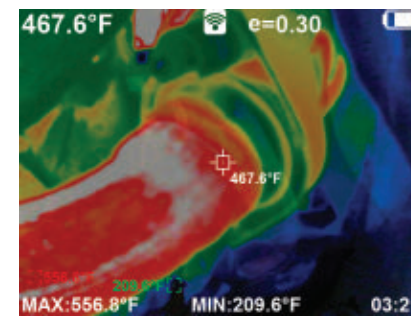
If the converter has failed, you also need to identify what caused the converter to fail. Sure, age is a factor – but there are other factors that can result in premature failure and if left uncorrected, the new replacement won't last long.

And if it the converter hasn't failed, you need to determine what caused the ECM to set the code(s) anyway. False catalytic converter codes are not uncommon and in many instances, a reflash is all that is required to correct the concern.

Start by taking the vehicle for a test drive. Is there any indication of sluggish response or low power that might indicate



After a quick visual, you can use a thermal imaging camera to "see" the converter in action.



Allow the engine to reach operating temp, and then check the temp of the converter's front weld ring.

an exhaust restriction resulting from a melted or broken substrate? Do you hear any rattling noises coming from the area of the converter?

Next, a scan tool check. First to verify the presence of the P0420 and/or P0430 DTCs but to also check for any others that might be recorded in the ECM. Any DTC or condition that increases emissions or affects sensor readings can cause a converter to fail the ECM tests even if the converter is good. Correct all other DTCs first and allow the Catalytic Converter monitor to run again before proceeding.

While the scan tool is connected, review the fuel trim data PIDs. Do they indicate a system lean or rich condition? If the vehicle is equipped with dual exhaust and dual converters, is one bank skewed lean while the other is skewed rich?

If the vehicle uses a conventional oxygen sensor upstream of the converter, graph and compare the signals from the upstream and downstream sensors. Most ECMs rely on this data to assess the condition of the converter. The front sensor should switch normally while the rear sensor should remain relatively steady. If it, too, fluctuates the same as the front sensor, it is an indication that the converter has failed OR the converter has not started working, also known as "lighting off", because of an emissions problem with the engine.

Vehicles using Wide Band Air Fuel Sensors use a different diagnostic strategy so take advantage of what the data Mode $06 has to offer to help in your diagnosis.

Next, put the vehicle up in the air and inspect the exhaust system and converters for damage or obvious leaks. Common sources of air leaks into the exhaust that can skew the ECM's tests are damaged flex pipes and stripped or damaged sensor threads.

A smoke machine, especially one that can adjust the amount of pressure delivered, is one way to find elusive leaks. The use of an ultrasound tool like this is another way to locate leaks that you can't visually see. Another simple way to check the exhaust is to connect your shop vacuum cleaner to the exhaust, moving the hose to the outlet side and turning it on. Seal the hose to the exhaust and use a soapy water solution to check for leaks.

Graph and compare the signals from the upstream and downstream O2 sensors.

Even slight variations in the air/fuel mixture will cause the converter temperature to rise significantly.

Low HC and CO levels with high NOx emissions are typically not caused by a defective converter.

After a quick visual, you can use a thermal imaging camera to "see" the converter in action.

Start the engine and allow it to reach operating temperature and check the temperature of the converter's front weld ring.

When using a five-gas analyzer, keep in mind that:

- High HC emissions indicate unburned fuel.
- High CO levels indicate partially burnt fuel or oil.
- High NOx levels are normally caused by high combustion temperatures and pressures, slightly lean air/fuel mixture, and excessively advanced ignition timing.

Tailpipe emissions readings low in HC and CO levels with high NOx emissions are typically not caused by a defective converter. The low HC and CO readings indicate that the converter is functioning. The root cause of the problem is an engine that is emitting excessively high NOx emissions, which in turn are caused by excessive combustion chamber temperatures.

Any cylinder that is not working as hard as the others is the most likely cause of emissions issues. Most professional scan tools can accurately perform a cylinder balance test by dropping one cylinder at a time.

You can also use the thermal imager to check cylinder power balance. Look for cylinders that are running hotter or colder than the others. Once identified, you can focus your attention on the odd man out.

Remember, diagnosing Catalytic Converter Efficiency Below Threshold DTCs requires you to do two things. First, determine the actual condition of your customer's converter, and second, determine what caused it to go bad in the first place, OR if the converter is good, determine what caused the ECM test to fail.

If you don't take the time to correct the true cause, you'll only set yourself up for a dissatisfied customer and an expensive comeback.

How diagnostic tools cut through the ADAS confusion

Technicians must overcome differences in ADAS technology with calibration tools and new industry standards.

By Mindy Long

Photo Courtesy of Precision Diagnostics

Not all shops have the tools to perform static calibrations, which can cause them to lose income.

Advanced driver assistance systems (ADAS) rely on a combination of cameras, radar, lidar, ultrasonic sensors, and other technologies to improve safety, but where those technologies are located, and how they interact with the vehicle, vary. The differences in these systems can make a technician's life difficult.

"There is a lot of confusion out there exactly how ADAS works, how to calibrate it, what can be calibrated, and what can't be calibrated," said Chris Freeman, director of sales and training for Autel North America. "We're getting a lot of different feedback from the dealers. No one puts these sensors in the same places. They're different from make-to-make and model-to-model."

Diagnostic tool providers such as Autel are equipping the industry with calibration tools to help close the gap as techs strive to ensure systems are working correctly.

"We're trying to clarify the information," Freeman said. "That way, we can give a clear picture of what needs to be programmed and what doesn't."

There are various elements to vehicle ADAS, including adaptive cruise control, around-view monitoring, blind-spot detection, lane departure warnings, light imaging detection and ranging, night vision systems, and rear collision warnings.

"Each of these has a different function and uses different sensors or a combination of sensors to function," said Brandon Alexander, marketing manager for Thinkcar.

Adding to the confusion, there aren't consistent expectations of ADAS capabilities for any given fleet or consumer vehicle.

"Because of that inconsistency, technicians don't know if a vehicle has the same capacity as the vehicle before it. I'm finding, too, that some technicians are even confused about what it means to perform a calibration and have it pass," said Jordan Krebs, worldwide alignment product manager at Snap-on Equipment.

Tom McGuire, chief operating officer of Precision Diagnostics said the industry hasn't even figured out how to standardize terminology in the U.S.

"With emergency assist braking across 35 different manufacturers, there are literally 35 to 40 acronyms they use to describe their systems," he said. "There is a tremendous challenge of having both access and the current level of service information to really support that technician in not only where the sensors and the components of the ADAS are, but also what is required to program or calibrate it correctly."

Scott McKinney, senior product manager at Bosch Automotive Aftermarket, said a lack of standardization, and the fact that ADAS technology is new, puts the responsibility squarely on the shoulders of the shop to ensure a calibration is completed properly.

"There are thresholds and tolerances that each system allows, which means there are instances where it may pass but not prevent an accident or perform as it should have in a real-world scenario, Krebs said. "The problem that many techs face is they don't know what may or may not be on the vehicle. Even the same vehicle built in a different time period may not have the same system they were just working on," he explained.

Alexander said that manufacturers establish the specific functionality within their vehicles and the calibration process. The general function of the ADAS components is similar between brands, but the ADAS calibration process will differ.

Fortunately, Fred Andersky, director of government and industry affairs for Bendix, said most OEMs make collision mitigation technology standard on their highway vehicles. "Each system has its own set of maintenance rules that are published by the manufacturer just like with any other system on the vehicle," he said.

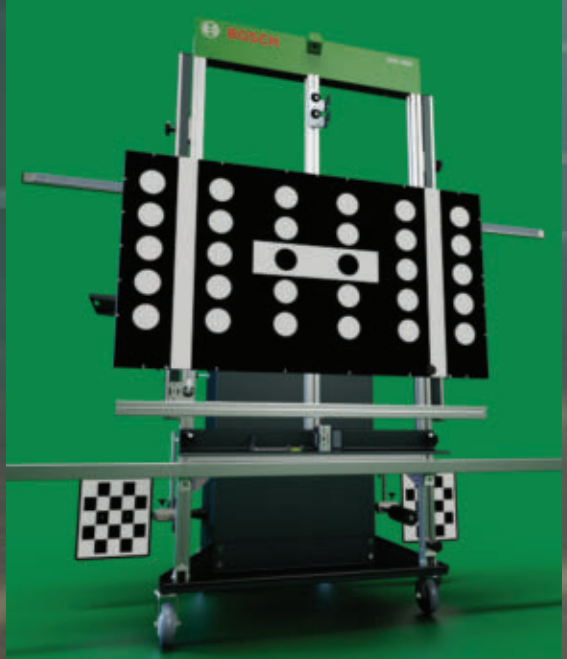
Invented for life

BOSCH

A powerhouse lineup of repair solutions from the global leader in diagnostics

Professional Diagnostics

The next generation of scan tools with the most advanced OE level vehicle coverage supporting scanning, live data access and complete bi-directional functions.



ADAS Recalibration

A seamless, full-system solution that guides you from setup through calibration in half the time.

Heavy Duty Diagnostics

Heavy duty solutions to help you get the repair done right and the vehicle back in operation.

Test, Tune and Analyze

Test, analyze and diagnose your vehicle electrical and mechanical systems.

Solutions for every job.

boschdiagnostics.com

For more information visit VehicleServicePros.com/10122252

The safety benefits of ADAS is understood, but the lack of regulation has slowed adoption.

UNDERSTANDING THE IMPORTANCE OF TOOLS

Marcos Obispo, director of sales for Cojali USA, said everybody seems to understand the safety benefits of ADAS, however, the lack of regulation has slowed adoption, and therefore the need for shops to invest in calibration equipment and training for technicians.

Calibration tools are helping to provide all necessary information to technicians, so they can prepare for the calibration and better estimate the time to repair, Krebs said.

Alexander said advanced scan tools will include detailed steps on how to set up the targets and framework, providing technicians greater confidence.

McGuire said his technicians utilize OEM information as well as calibration tools. "We like to have both. For a technician to work on it without a tool, they become almost a liability rather than an asset," he said. "You can have a great technician, but without accurate, up-to-date service information, you're chasing things you shouldn't have to chase."

Completing an ADAS calibration using the standard OE process can take up to an hour, McKinney said, but with Bosch's DAS 3000, that exact calibration can be completed in under 10 minutes.

Obispo said calibrations could be either dynamic or static, which are not interchangeable. Some systems can be calibrated by driving the vehicle while using a handheld or diagnostics device connected to the ADAS, which is the dynamic calibration. According to the manufacturer, the tool will tell the technician how to drive during the calibration. Static calibrations are performed with the vehicle stopped. "In this case, we would need specific, sensitive calibration equipment to calibrate and test the ADAS modules to ensure their correct functioning," he explained.

Not all shops have the right tools needed to perform static calibrations, which can cause them to lose income. If repairers want to continue being competitive, they will have to seriously consider this new market demand, Obispo explained.

MEETING TECHNICIANS' CHALLENGES

The most common obstacle techs face is familiarity with the calibration process. "As with any newer technology, it is taking time for technicians to become comfortable with ADAS and gain the knowledge specific to calibrations," Alexander said. "Until that time, a limited number of technicians will be willing and trained to perform the calibrations, resulting in labor shortages."

Brian Screeton, supervisor of technical service training at Bendix, said radar alignment tends to be one of the top issues technicians encounter. "While radars today do a great job in adjusting their alignment, it can still happen that a radar needs to be aligned by the technician," he said. "The other issues typically tie to the braking system. If the ABS goes out, then both stability and collision mitigation are deactivated. If stability goes out, then collision mitigation is deactivated."

Often, issues with ABS are tied to wheel speed sensors, with the gap between sensor and tone ring being too great because the sensor was pushed back in the clip during a previous wheel end repair or a worn spring clip, Screeton said. Another area often overlooked is some type of wiring harness issue, such as a wire casing that may be cut.

One of the stumbling blocks for technicians when repairing ADAS is not looking beyond it. ADAS relies on information from many other parts of the vehicle, including the ABS and stability systems. "Other systems, mainly the drivetrain, supply information that ADAS requires to function correctly," Screeton said. For example, an 'Adaptive Cruise Fault' could be activated by ADAS, and the root cause of the fault could stem from an engine issue.

A somewhat common situation that can cause lost repair time is not paying attention to J1939 communication errors first, especially ones that are being reported by multiple systems, Screeton said. "We recommend that technicians resolve those diagnostic troubleshooting codes first, then rerun the Bendix ACom PRO diagnostic software to see what remaining DTCs may remain," he said.

Systems have unique ways that they are calibrated and require different tools and procedures to perform calibration and

alignment, Screeton said. Having the correct tools and service information for the ADAS the technician is repairing is crucial.

"We recommend that all technicians troubleshooting Bendix electronic systems, including ADAS, use Bendix ACom PRO or Noregon's JPRO software," he said. "Those PC-based, subscription-based diagnostic tools are comprehensive to cover all Bendix electronic systems and offer a complete suite of diagnostics, troubleshooting, advanced troubleshooting, and reporting capabilities for both tractor and trailer systems."

A second element that can present an issue is the space and environment required for calibrations. The area needs to be level, free of obstructions, and have ample lighting.

"Technicians have to know how to prepare the shop environment before starting the calibration. The OEM may provide the information in the service manual, but then the technician has to go through that service manual, and it adds to the time," Krebs said. "There is a lot out there and a lot of confusion on what it takes to have a clean environment."

ADAS calibration tools consist of the targets, framework to position the targets, and diagnostic tablets to access the CAN, Alexander explained. "High-quality targets are key to providing an accurate reference point for digitally calibrating the vehicle sensors," he said. "The targets must be at the exact height, angle, and distance relative to the vehicle, and a solid framework with alignment accessories is critical to hold the targets in the precise position. Professional-level diagnostic tablets are essential to accessing the vehicle onboard network to initiate and confirm the calibration process."

ADAS technology changes frequently, so regular software updates for calibration tools are critical. "For our technicians, whether they're in one of our brick-and-mortars or are mobile, there are constant updates being sent to tools. If you don't update it, you're looking at the front end of a car looking for a sensor that should be at point A, but at the mid-year model change, they moved it," McGuire said, adding that he does a lot of work with Autel. "They do a nice job of providing you with auto-updates as long as you use them. You waste a lot of time without updates."

EDUCATING BUYERS

Technicians are undergoing a learning curve related to ADAS, but buyers also have to gain a new understanding of the technology. For vehicle owners, there are things they can no longer do. "For instance, a lot of truck owners would buy a truck and replace the plastic bumper with a chrome bumper. With ADAS, you have to have one that works with it. There are things like that you have to think about now," Freeman said.

McGuire explained that ADAS technology is a living, breathing component of the vehicle. "You have to be aware that once you modify as built, you could have changed how it works," he said.

Every time a windshield gets replaced, it has to be recalibrated, and even an aftermarket windshield rather than an OE windshield could create challenges. "Some aftermarket windshields have more wave to them, or the tint level could be off in some cases," Krebs said.

Autel's Freeman explained that even a small bump, such as hitting a curb or a small animal, can cause problems if the system isn't recalibrated. "The slightest bend can take a sensor from reading straight to reading at an angle." he said.

MONITORING MANDATES

In the U.S., there is not a mandate for ADAS like there is in Europe. "In Europe, everyone has to have it, and it is a done deal," Freeman said.

Bendix's Andersky said mandates may be coming to the U.S. "In the Infrastructure Investment and Jobs Act, the recently passed 'infrastructure bill,' there is a requirement that NHTSA promulgate a rulemaking for autonomous emergency braking on Class 7 and 8 tractors and motorcoaches within two years," he said. "There is also a study requested for eventually mandating on Classes 3-6 trucks."

Additionally, the U.S. government's new car assessment program is getting a major update, which is moving the country closer to an ADAS mandate, Obispo said.

There has also been work to standardize terminology. While there are numerous marketing and brand names for ADAS, SAE and AAA have recommended a classification for naming 20 different types of ADAS, McKinney said.

Creating standardization is not an easy task because of the dynamic and changing nature of ADAS development, Obispo said. "Traditionally, there have been a lot of acronyms and naming given to these systems," he said. "Manufacturers used to put their own names to similar technologies, which of course did not help much to the comprehension of the systems."

GOING FORWARD

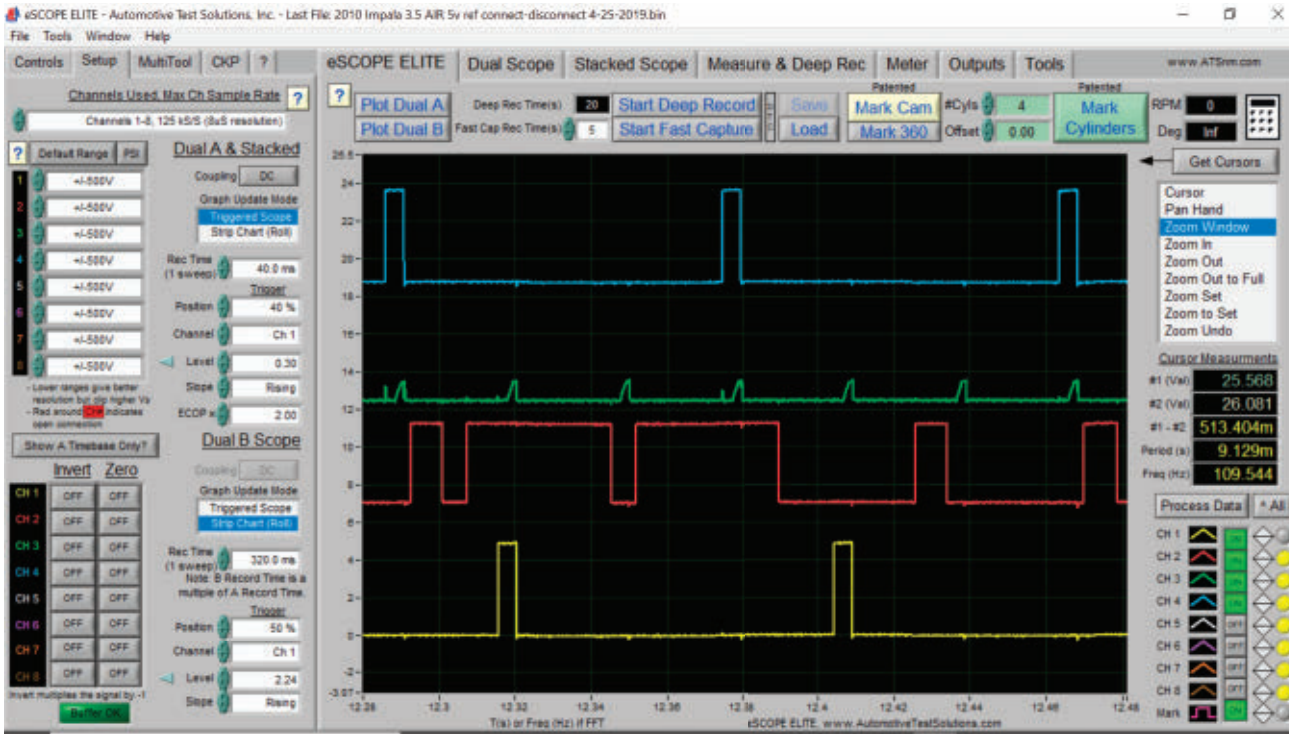
Because there are so many variables and the technology is continuing to emerge at a lightning pace, it's going to become more challenging in the near- to mid-term for technicians to perform the tasks they're required to perform, McGuire said. "As technologies and systems are advancing and more are being added, the lack of standardization really drives an incredible wedge between time and efficiency," he emphasized.

In the future, equipment and technology providers can expect more systems to address the safety features. "Bosch is planning for these changes with upgradeable technologies to integrate in the shop now and grow with the technicians' skill and expertise as the industry moves toward digitalization," McKinney said.

When the tools become the tutor

Becoming a valuable technician takes time and comprehension. But using your tools to help conduct the lessons is a priceless commodity.

By Brandon Steckler



The DSO offers a visual representation of electricity and action/reaction comparative measure of different circuits simultaneously.

Any experienced automotive technician will tell you that most diagnosticians develop their skillset over time, they aren't necessarily born with it; I couldn't agree more. My rate of learning and comprehension drastically increased as I began to implement tools used for diagnostics.

VISUALIZING ELECTRICITY

I'll begin by describing one of the most valuable tools at a diagnostician's disposal, the DSO (Digital Storage Oscilloscope). This tool is highly coveted because it performs all the duties of most DVOMs but also offers a visual representation of what is occurring in the circuit. More importantly, most scopes today support this functionality for multiple channels. It's common to see four channels but some even support eight channels. Seeing multiple circuits operate before your eyes has many benefits. Here are a few of my favorites:

- History of electrical activity (not just what occurs at a single moment in time)
- Action/Reaction view (how these multiple signals interact with one another; **example:** *Input vs Output*)
- Information stored in a buffer (no need to babysit the scope, it will capture and save the fault)

MEASURING DEVICES

Another brilliant technology is the ability to plot measuring cursors and rulers. Many scopes will allow for two cursors to be placed vertically (to allow for measuring a single point in time or the delta time between the two cursors). This becomes particularly handy when calculating events like the dwell of an ignition coil or the duration of a spark event. The waveform view itself may ➲

AUTEL MAXISYS
EV DIAGNOSTICS

THE POWER OF EVOLUTION

SECURE HIGH VOLTAGE SYSTEM TESTING

MAXISYS MS909

MAXISYS ULTRA

DETAILED BATTERY PACK DIAGNOSTICS
STATE OF CHARGE & STATE OF HEALTH ANALYSIS

SPECIALIZED BATTERY ANALYSIS VIA BMS
DETAILED CABLE CONNECTION DIAGRAMS

POWERFUL HARDWARE

- 12.9' Touchscreen (Ultra)
- Octa-core Processor
- Android 7.0 System
- 4G+256G Storage

INTELLIGENT SOFTWARE

- EV High-Voltage System Diagnostics
- Covers All Functions Of Ultra
- Topology Module Mapping
- Repair Guided Procedures
- Related TSBs / DTC Analysis

EV DIAGNOSTICS UPGRADE KIT

KIT INCLUDES

EVDiag Box & Adapters for Specific Electric Vehicles to Perform Battery Pack Analysis.

COMPATIBLE TABLETS

- MaxiSYS Ultra
- MaxiSYS Ultra ADAS
- MaxiSYS MS919
- MaxiSYS MS909

(Connects to MaxiFlash VCI or VCMI)

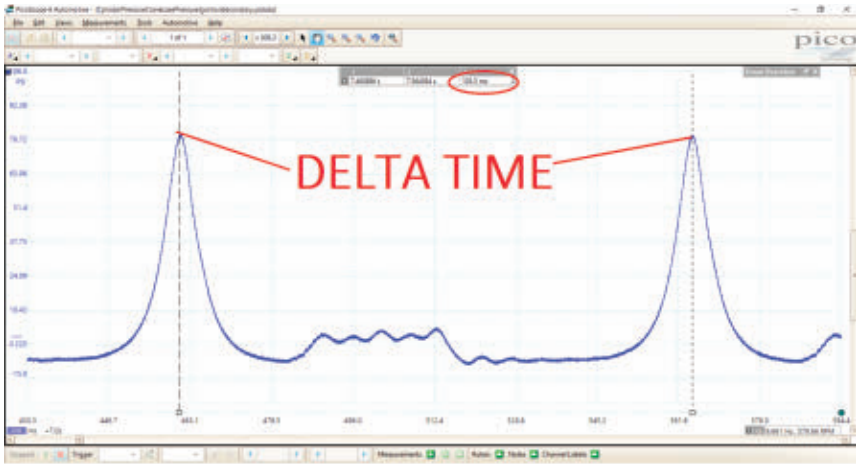
For more information visit VehicleServicePros.com/21239998

SUPPORT: 1.855.288.3587
EMAIL: USSUPPORT@AUTEL.COM | WEB: AUTEL.COM
VIEW MARKETING MATERIAL: ISSUU.COM/AUTEL2
FOLLOW US @AUTELTOOLS

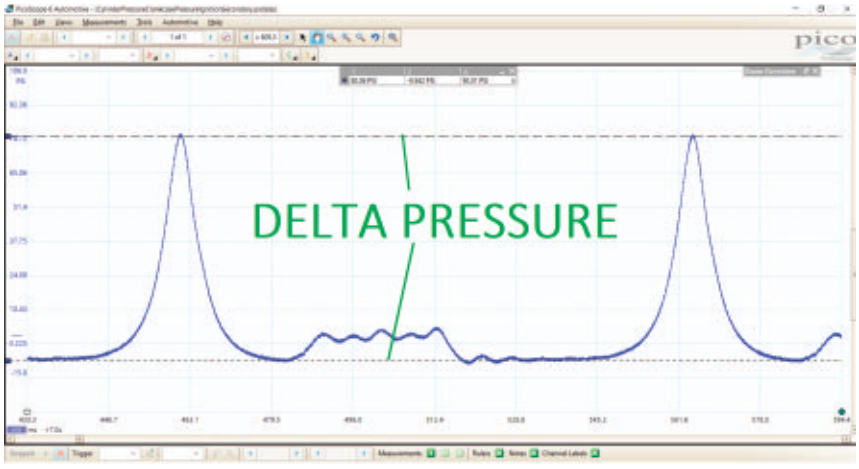
AUTEL LIVE CHAT TECH SUPPORT

AUTEL TECH SUPPORT WE SUPPORT ASE TECHNICIANS

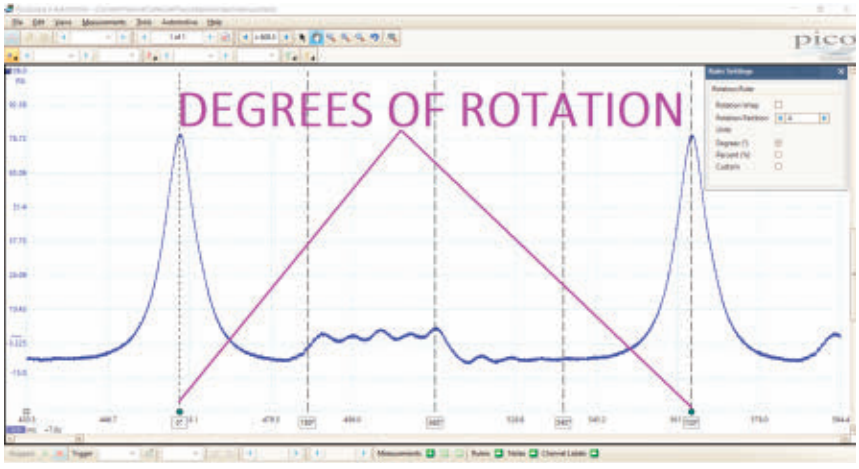
AUTEL



Vertical cursors are handy when calculating events like the dwell of an ignition coil or the duration of a spark event. The image above displays the duration of a 720-degree engine cycle.



The horizontal cursors measure the amplitude or value of a signal when used singularly or the difference value between two measuring-points when used in tandem.



The rulers use the scope's software to associate elapsed time with either "percentage" or "degrees of rotation." A truly valuable tool, especially when it comes to engine mechanical analysis.

display a subtle fault that is not apparent to the naked eye. The vertical cursors can offer a more scientific approach to waveform analysis.

Like the vertical cursors, the scope may also offer two horizontal cursors to display a signal amplitude measurement, regardless of the domain you are measuring in (voltage, amperage, duty-cycle, pressure, temperature, etc.). For the same valuable reasons, the horizontal cursors can display minor variations that are not easily visible.

Rulers are another hot commodity. The rulers use the scope software to associate elapsed time with either percentage or degrees of rotation. A truly valuable tool, especially when it comes to engine mechanical analysis. Although this type of calculation can be easily performed using only the vertical cursors and a calculator, implementing the rulers allows the information to be displayed directly and instantaneously on the scope screen. The measuring cursors can then be used to determine delta degrees (indicating the duration of an event, like the open time of a cylinder's intake or exhaust valve).

OVERLAY SOFTWARE

One of the most important tools I own besides the DSO is what is known as overlay chart software. The software offers many different configurations to allow for the accomplishment of multiple tasks. However, the one feature I'm most fond of is known as a piston chart.

I frequently perform many engine-mechanical analyses, and a common issue I face is explaining my findings to my customers (or fellow technicians wanting to learn). The Piston chart offers me the ability to point out what it is I'm seeing in the capture. In other words, to tell the story as it unfolds.

The piston chart is handy because it references all cylinder activity simultaneously, anywhere within the entire ➲

#1 TRUSTED SOURCE FOR ASE TEST PREP

YOU PASS OR YOU DON'T PAY!

MOTOR AGE TRAINING

WE SUPPORT PROFESSIONAL CERTIFICATION THROUGH THE National Institute for AUTOMOTIVE SERVICE EXCELLENCE

www.passthease.com

720–degree engine cycle. Here are just a few of the benefits:

- Comparison of piston position and direction of travel, from cylinder to cylinder
- The firing order is always displayed
- Valve overlap periods
- Top Dead–Center points/ignition events

The piston chart is plotted either superimposed on the existing waveform or above/below the existing waveform. Implementing it is as simple as opening a new window on your PC. Regarding the return on investment, the tool typically pays for itself the very first time it is implemented.

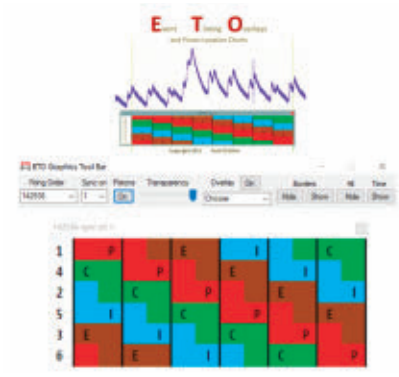
SERVICE INFORMATION

Many technicians and shops in general take service information for granted. There is a lot more to it than simply referencing removal and installation instructions, labor time guides, or diagnostic flow charts. Adequate service information can yield a diagnostician a boatload of know–how without ever leaving the workbench. The following are some of the search criteria I frequently reference:

1. System description/operation– We all know that each vehicle may be configured differently. This means there are multiple ways to accomplish the same intended goal and multiple options for system configuration. Having access to this piece of the diagnostic puzzle is priceless. Establishing a game plan before approaching the vehicle is what it takes to stay efficient and accurate. Avoid the pitfalls that so many encounter when they don't take the time to research this important piece of information. Approaching the vehicle without anticipation of what is supposed to occur (under certain operating conditions) is a recipe for misdiagnosis and/or expensive and embarrassing comebacks.

2. Wiring diagrams– Like what was just stated above, each vehicle has the potential to be configured differently. For instance, depressing a horn pad may energize a relay to allow for a horn to sound. However, that same horn pad on a different vehicle may provide a ground path (but not for the relay) for a signal circuit to an electronic control unit (ECU). That ECU may send that horn request to another ECU on the network. It is the job of that second ECU to energize the horn relay. After all, the horn sounds the same in either configuration. Having access to and choosing to reference that system wiring diagram, in combination with the system description and operation will allow you a few benefits:

- Identify system configuration and functionality
- Develop anticipation of the test results before approaching the vehicle
- Determine the best testing locations with the least amount of invested time



Overlay software like the ETO by "The Driveability Guys" offers an easy-to-view piston chart to help identify engine-mechanical faults without disassembly.

The need for relevant service information is always present as it gives the technician information required for a proper analysis.

3. Flowcharts– I use diagnostic flowcharts like many of us technicians do. However, I implement them differently. I choose not the follow the flowcharts, word for word. In fact, if I encounter a step in the diagnostic flow chart procedure that does not make sense to me, I do not proceed with that test. It's simply because I wouldn't know how to anticipate the results. I use flow charts for bits of data that only the manufacturer's engineers would know (they designed the systems). I will reference the flow charts to understand the thresholds or when the ECU determines there is a fault present. Understanding what the ECU desires is part of the diagnostic process.

Other pieces of data like resistance specifications or rate of pressure leakdown (and such) are desirable to be aware of as you will then know how to interpret the test results. Not having access to this information will leave you guessing and either have you replacing components for no reason or allowing a failing component or system to slip right past you.

THE DIAGNOSTIC PUZZLE

Being able to provide solutions to diagnostic challenges is something most of us will have to face at some point in our careers. Solving these diagnostic dilemmas is only one part of the equation. Doing so in a timely fashion is the other.

We can choose to have diagnostics as a hobby or a career. The main difference between the two options is efficiency. The examples above are just a few of the tricks I have up my sleeve. Be creative in the way you choose to implement your tools. They will likely serve you well and give you a more solid understanding of what is truly occurring in the systems and components you are forced to address each day.

READS/CLEARS CODES FOR ALL AVAILABLE SYSTEMS

The **OTOFIX D1 Lite Diagnostic Tablet** is designed to provide one-stop solutions when paired with the OTOFIX cloud-based app. It's able to read/clear codes for all available systems, display live data in text, graph, and analog for easy data review, and automatically identify vehicle make, model, and year information via AutoVIN technology. Additionally, the D1 Lite Diagnostic Tablet supports battery diagnostics with BT1 Lite Smart Battery Tester (purchased separately).

For more information visit VehicleServicePros.com/21258527

NOW INCLUDES IVS 360 SUPPORT

The **Opus IVS Remote Assisted Programming (RAP) Platform** now includes IVS 360 Support for live, on-demand assistance from a team of hundreds of OEM Dealer Master Technicians. RAP, now with IVS 360 Support, continues to free up automotive technicians to do higher-skilled work and increase shop profitability with the Opus IVS team of experts doing the programming remotely, plus now provides help for complex diagnostic issues. RAP with IVS 360 Support eliminates the need to send complex vehicles to the dealership or call a mobile technician for programming or diagnostics, the company says.

For more information visit VehicleServicePros.com/21284583

ABLE TO TEST SEVEN DIFFERENT 12V RELAYS

The **Electronic Specialties Super Relay Buddy**, No. 194, is designed to provide an indication of the general health and functioning of the most common 4/5 pin 12V relays. It cycles the relay several times while loading the switch contacts to detect any excessive resistance. The tool incorporates a full 7A load into the automated test sequence and is able to test seven different 12V relays. In addition to displaying green for good and red for fail, the Super Relay Buddy has a third test result, yellow for caution. The yellow/caution result is displayed when the voltage drop through the tested relay is significant, but still within operating range of the relay.

For more information visit VehicleServicePros.com/21276213

PROVIDES QUICK, HIGH-ACCURACY TESTS FOR EV BATTERY PACKS

The **E-XTEQ E-VLT Leak Tester** is designed to provide quick, high-accuracy tests for EV battery packs, electric motor cavities, and gearbox housing/cooling systems. E-VLT is equipped with three different test options which include hydrogen, smoke, and snoop test. It utilizes Argos cloud-based system for job traceability, test parameters, and threshold updates.

For more information visit VehicleServicePros.com/21258927

SUPPORTS CANFD PROTOCOL

The **Thinkcar THINKDIAG 2** is a diagnostic device that supports CANFD protocol, providing fast and accurate diagnostics. With added vehicle model support, the device offers OBD-II full functions, full system diagnostics, 15 reset functions, remote diagnostics, real-time data stream, automatic VIN reading, actuation tests, reads fault codes, and clears fault memory. It also features a soft rubber sleeve made from ABS+ silicone with double-sided indicators that allows users to directly observe the working status of the product under any circumstances.

For more information visit VehicleServicePros.com/21259362

FEATURING CANFD AND DOIP ADVANCED PROTOCOLS

The Android-based **Millennium MAX** from **Launch Tech** can perform 29 advanced service functions and support CANFD and DoIP protocols, making it a professional level diagnostic tablet. Featuring a 7" touchscreen and intuitive interface, the tablet is easy to operate. It also supports full system diagnosis to read and clear trouble codes as well as offers auto detect VIN, Wi-Fi software updates, generates and shares diagnostic reports, and more.

For more information visit VehicleServicePros.com/21271480

FEATURES BOTH LASER AND THERMAL COMPONENTS

The **Snap-on Diagnostic Thermal Laser** combines temperature readings of up to 1,800 degrees F (1,000 degrees F in thermal mode) and thermal imaging capabilities by featuring both laser and thermal components. By offering both thermal and laser modes, the tool is ideal for jobs such as checking inlet and outlet temperatures of catalytic converters. Additionally, it features thermal image blending, plus a visible-light camera to provide more detail, and delta reading in laser mode to capture highs, lows, and delta. The trigger takes pictures and stores hundreds of images as well as captures temperature readings.

For more information visit VehicleServicePros.com/21257811

FLEXIBLE TO INSPECT HARD-TO-REACH SPACES

The **ANSED Diagnostic Solutions Hi-Res Digital Video Scope Kit with 6mm Articulation Probe**, No. DVSK-60ART, features a 6mm diameter articulation imaging probe that lets the user look back up to 180 degrees, making it ideal for any engine work. The videoscope is flexible, allowing users to monitor, capture, and inspect hard-to-reach spaces and cavities. The video monitor supports 13 languages, offers a 3.5" full view IPS LCD display, and has a solid rubber boot protector for shock resistance. The DVSK-60ART kit also contains an 8G SD mini card, USB cable for charging, user manual, and a hard-shell plastic carrying case.

For more information visit VehicleServicePros.com/21230447

PROVIDES LOCAL AND REMOTE DIAGNOSIS

The **TOPDON Phoenix Remote** is designed to provide local and remote diagnosis. It supports voice and video calls to ensure that users have real-time communication options available, allowing users to speak directly with professional service and repair technicians to discuss programming, the remote diagnosis process, or resolve troubleshooting and technical issues. The scan tool provides coverage to over 200 types of passenger cars and new energy vehicles, features a 10.1" oil-proof LCD touchscreen, and contains online coding for more than nine major vehicle brands. It also supports CAN2.0, CANFD, DoIP, J2534, D-PDU, and RP1210 protocols and includes over 34 common maintenance functions.

For more information visit VehicleServicePros.com/21268858

ADDS 'MANAGE PHOTOS' FEATURE

The **Bosch ADS and ADS X 5.1, 5.2, and 5.3 Software Updates** further improve user experience by introducing a 'manage photo' feature, allowing technicians to launch the camera or upload existing photos to scan reports, special test, and calibration reports. Additionally, the software updates add new special tests, systems applications, more 2022 coverage, and new 2023 vehicle coverage. The ADS software updates include coverage for domestic and foreign 2022 and 2023 vehicle coverage including various models from Buick, Jeep, GMC, Mercedes, Alfa Romeo, and more.

For more information visit VehicleServicePros.com/21285229

FOR MAXISYS ULTRA, MS919, AND MS909 TABLETS

The **Autel Remote Expert Platform** is for all MaxiSYS Ultra, MS919, and MS909 tablets nationwide. The Remote Expert platform connects technicians with independent module programmers, automotive diagnosticians, and system experts who use the peer-to-peer network to perform needed services remotely. Using an Autel Ultra, MS919, or MS909, a technician simply writes the order with vehicle identification and the issue and submits it to the Expert community. The Expert sends a quote on the job directly to the tablet. Once the price is set, the Expert connects the hardware and Autel Remote Expert device to one of Autel's multiple Pass-Thru servers. No additional hardware is required.

For more information visit VehicleServicePros.com/21278567

ABLE TO SELECT LEVEL OF COVERAGE

The **Matco Tools Maximus Flex Pro Diagnostic Scan Tool** is an Android-based tablet with 10.1" high resolution touchscreen designed to be flexible to let users choose the level of coverage that works for them, from fully-loaded coverage, monthly subscriptions, or a basic version with enhanced code reader. The scan tool comes with a rugged case for durability and is IP65 rated. It also fully supports the security gateway module with special access to select 2018 and newer FCA US vehicles with Auto Auth subscription (purchased separately).

For more information visit VehicleServicePros.com/21283111

ACCELERATE

A MOTOR AGE TRAINING EVENT

MOTOR AGE TRAINING | PTEN | MOTOR AGE | ABRN | VEHICLESERVICEPROS

SCOTT BROWN

Session: ENGINE CONTROLLER CALIBRATIONS: Developing New Perspectives for Drivability Technicians

PETE MEIER

Session: ELECTRICAL CHALLENGES: Three Steps to Successful Electrical Troubleshooting

BRANDON STECKLER

Session: SCAN TOOL ANALYSIS 101: Gaining Diagnostic Direction From The Driver's Seat

G. JERRY TRUGLIA

Session: HYBRIDS & EVS: Understanding and Diagnosing Hybrid / Electric Vehicles

UNLIMITED ON-DEMAND ACCESS UNTIL JANUARY 31, 2023

Recorded Live in October in Rosemont, IL, the complete ACCELERATE training event (8 HOURS OF TRAINING) is now available On-Demand. Don't miss these educational sessions. Shop professionals, educators, and automotive repair students interested in upping their game when it comes to vehicle repair diagnostics, solving electrical issues and dealing with hybrid and electric vehicle repairs will want to take advantage of this virtual opportunity. Our technical experts are nationally recognized as some of the best in the business. Register today and get immediate access to four technical courses and learn about new products and repair solutions from leading vendors offering tools, shop management assistance and vehicle repair parts and services.

PREMIER SPONSOR: AUTEL

SIGNATURE SPONSOR: Milwaukee

PRIMARY SPONSORS: REPAIR PAL, AutoLeap

WWW.ACCELERATE-CONFERENCE.COM

LAUNCH
TECH USA
CREATE • CHANGE

30TH SINCE 1992 LAUNCH

EXPERIENCE THE LIGHTNING

Integrated Oscilloscope and DMM Multimeter Functionality

X-431 FIX Database

X-431 Torque 5

- LATEST 10.1" TABLET
- ANDROID 10.0 SYSTEM
- 4GB+128GB STORAGE
- 2 CHANNEL OSCILLOSCOPE
- TOPOLOGY MODULE MAPPING
- ADVANCED CANFD AND DOIP PROTOCOLS (OPTIONAL)
- CODE ASSIST DATABASE BY IDENTIFIX
- X-431 FIX REPAIR DRIVEN BY MOTOR DRIVEN
- WI-FI & BLUETOOTH CONNECTION

LAUNCH

www.launchtechusa.com 1-877-528-6249 @LaunchTechUSA