Motor Age®

ADVANCING THE AUTOMOTIVE SERVICE PROFESSIONAL SINCE 1899

PROFIT MOTIVE

CARS DON'T MATTER – FOCUS ON PEOPLE AND LABOR FOR SUCCESS 8

informa markets

NOVEMBER 2019

VOL. 138, NO. 11 // MOTORAGE.COM

Motor Age®

ADVANCING THE AUTOMOTIVE SERVICE PROFESSIONAL SINCE 1899

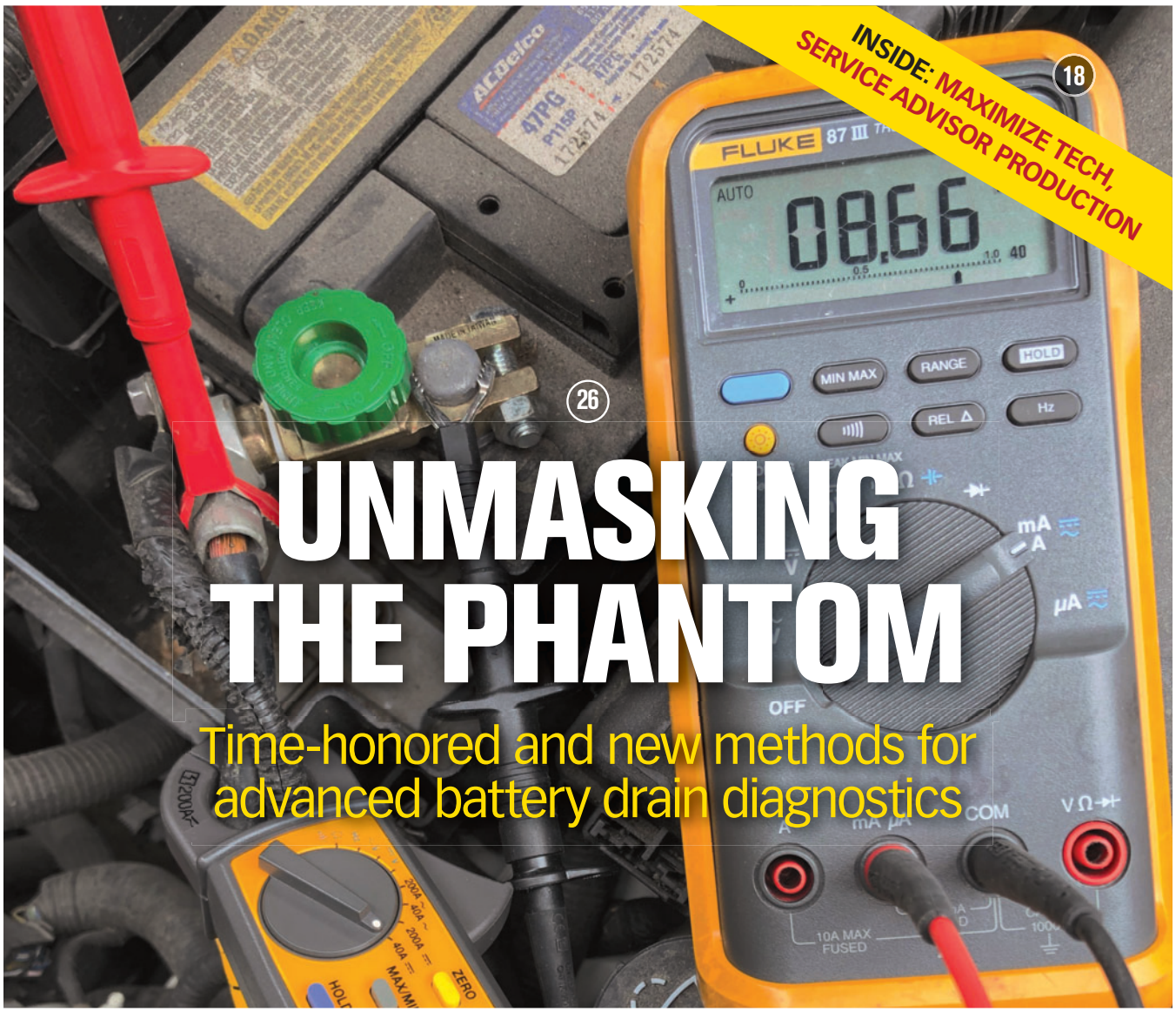
PROFIT MOTIVE

CARS DON'T MATTER – FOCUS ON PEOPLE AND LABOR FOR SUCCESS 8

informa markets

NOVEMBER 2019

VOL. 138, NO. 11 // MOTORAGE.COM



INSIDE: MAXIMIZE TECH, SERVICE ADVISOR PRODUCTION 18

26

UNMASKING THE PHANTOM

Time-honored and new methods for advanced battery drain diagnostics

46

KEEPING COOLANT IN THE COOLING SYSTEM

Is your customer's cooling system ready to weather winter?

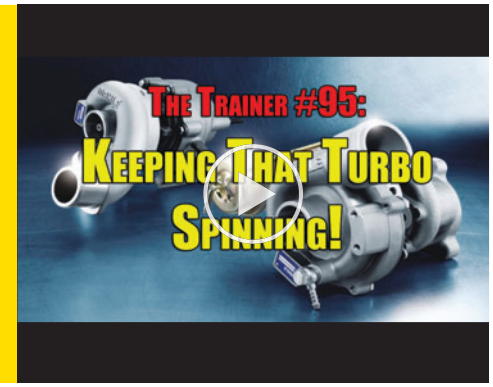
58

CAN LUCK BE CONSIDERED DIAGNOSTICS?

There are times, despite our best efforts, we can't determine the root cause of a problem — and then we get lucky!

80

THE TRAINER: HOW TO KEEP THAT TURBO SPINNING!



We're thankful for customers like you.

Enjoy these savings on us.

INDEPENDENT REPAIR FACILITIES:

Get an additional discount of up to 15% off select Genuine Volkswagen Brake Pads, Brake Discs, and Wiper Blades through repairlink℠.*

Offer valid 09.16.19–12.15.19.

Order at RepairLinkShop.com today.

*Offer valid on parts purchases made between 09.16.19 and 12.15.19 through the RepairLink application only. Discounts vary by part and are valid on select Genuine Volkswagen Parts only. Valid at participating Volkswagen dealerships only. See dealer for complete details.

Wholesale Parts

Volkswagen

Motor Age®

ADVANCING THE AUTOMOTIVE SERVICE PROFESSIONAL SINCE 1899

Talk Shop Anytime

NOVEMBER 2019

VOL. 138, NO. 11 // MOTORAGE.COM

OPERATIONS

TECHNICAL

IN EVERY ISSUE

WEB EXCLUSIVES // MOTORAGE.COM

EXPAND YOUR BRAND INTERNATIONALLY: NO INVESTMENT, ALL REWARD

Bonnier Corp. is hosting an automotive festival — called the Riyadh Car Show — featuring hundreds of leading brands in Riyadh, Saudi Arabia, Nov. 21-26, 2019.

Hear now from Jonathan Moore, SVP Events, Bonnier Events, as he explains the show and the no-strings-attached way the companies you buy tools and equipment from can exhibit.

As part of the Saudi Arabian kingdom's Vision 2030, the Riyadh Car Show aims to bring the aftermarket and specialty industry to citizens as well as new business for global brands. Learn more now.
MOTORAGE.COM/RIYADH

Motor Age

MOTORAGE.COM
1100 Superior Ave. Suite 800 // Cleveland, OH 44114
Phone: (216) 696-7000

EDITORIAL STAFF

MICHAEL WILLINS
GROUP CONTENT DIRECTOR
michael.willins@ubm.com
(440) 891-2604

KRISTA MCNAMARA
CONTENT CHANNEL DIRECTOR
krista.mcnamara@ubm.com
(440) 891-2646

CHELSEA FREY
SENIOR ASSOCIATE EDITOR
chelsea.frey@ubm.com
(440) 891-2645

PETE MEIER ASE
TECHNICAL EDITOR
pete.meier@ubm.com

STEPH BENTZ
ART DIRECTOR

STALIN ANNADURAI
SENIOR DESIGNER

JAMES HWANG
EDITORIAL DIRECTOR, ASE STUDY GUIDES
james.hwang@ubm.com
(714) 513-8473

CONTRIBUTORS

ROBERT BRAVENDER
CHRIS CHESNEY
CHRIS FREDERICK
DAVE HOBBS
JOHN D. KELLY
TONY MARTIN
DAVE MACHOLZ
SCOT MANNA
RICHARD MCCUISTIAN
MIKE MILLER
ALBIN MOORE
ERIC OBROCHTA
SCOTT SHOTTON
BERNIE THOMPSON
G. JERRY TRUGLIA

PRINTED IN U.S.A.
Connectiv
The Business Information Association, a division of SIIA

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

MEMBER OF:
SIMA, iATN, ASA Sponsored Benefit Provider, MEMA, autocare ASSOCIATION Independence drives us., ASE

BUSINESS STAFF

JIM SAVAS
VICE PRESIDENT/GENERAL MANAGER

TERRI MCMENAMIN
GROUP PUBLISHER
terri.mcmenamin@ubm.com
(610) 397-1667

DAVID PASQUILL
COMMERCIAL FINANCE PARTNER

SOFIA RENTERIA
BUSINESS ANALYST

JILLENE WILLIAMS
SALES COORDINATOR

KAREN LENZEN
SR. PRODUCTION MANAGER
(218) 740-6371

TRACY SKALLMAN
AUDIENCE DEVELOPMENT MANAGER
(218) 740-7204

TSCHANEN BRANDYBERRY
SPECIAL PROJECTS EDITOR

DOMESTIC SALES

MIDWEST & WESTERN STATES, CLASSIFIED SALES

MICHAEL PARRA
michael.parra@ubm.com
(704) 919-1931

ILLINOIS, EASTERN & SOUTHERN STATES

PAUL ROPSKI
paul.ropski@ubm.com
(312) 566-9885
Fax: (312) 566-9884

OHIO, MICHIGAN & CALIFORNIA

LISA MEND
lisa.mend@ubm.com
(773) 866-1514

REPRINT SERVICES
Licensing and Reuse of Content
Contact Wright's Media at
informa@wrightsmedia.com
or call 877-652-5295
for more information.

CUSTOMER SERVICE
For Subscription Inquires or Changes
Email – passthease@ubm.com
or Call 800-240-1968

Motor Age (Print ISSN: 1520-9385, Digital ISSN: 1558-2892) is published monthly, by UBM LLC, 325 W. 1st Street, STE 300 Duluth, MN 55802. Periodicals postage paid at Duluth, MN 55806 and additional mailing offices. POSTMASTER: Send address changes to Motor Age, P.O. Box 6019, Duluth, MN 55806-6019. Please address subscription mail to Motor Age, P.O. Box 6019, Duluth, MN 55806-6019. Canadian G.T.S. number: R-124213133RT001. One-year rates for non-qualified subscriptions: U.S. $70.00; Canada/Mexico $106.00; International surface $106.00.

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

APOLLO-D8™ TRITON-D8® ZEUS®

INTELLIGENT DIAGNOSTICS

EVERYTHING YOU NEED. NOTHING YOU DON'T.

Get only the information you need for the vehicle you're working on and the problems you're solving. All on one screen.

SureTrack® | Real Fixes | Filtered TSBs | Smart Data
Specific Functional Tests | Specialized Resets
Guided Component Testing | Custom Test Meters

To learn more, talk to your Snap-on Franchisee. Or visit diagnostics.snapon.com

Snap-on®

INDUSTRY TRAINING

BOSCH, CASTROL PILOT JOINTLY BRANDED WORKSHOP CONCEPT

MOTOR AGE WIRE REPORTS //

The Automotive Aftermarket division of Robert Bosch GmbH and Castrol announced a new partnership, which will run jointly branded workshop pilots in China and the U.S. The pilot phase began last month in Suzhou (China) and Orlando/Tampa. The partners currently envisage that this test will include up to 25 joint workshops in each of these markets.

Bosch and Castrol each bring vast experience in the car service field. In addition to Castrol lubricants, Bosch parts and service offerings, each company will contribute its unique expertise in developing successful workshop concepts. Castrol's long history of consumer marketing and insights, combined with Bosch long-standing expertise in workshop management, equipment and services, will create a sustainable and profitable offer for workshop owners.

The concepts being tested include advanced, digitally-enabled services bringing drivers the highest levels of

>> PILOT CONTINUES ON PAGE 6

BREAKING NEWS

PODCAST

ASA LAUNCHES NEW WEEKLY PODCAST SERIES

ASA announced the launch of a new weekly podcast series hosted by industry veteran Tony Molla, ASA's vice president of Industry Relations.

The tagline of the new ASA Podcast defines the content as keeping ASA members and the industry at large abreast of "What's Now, What's New and What's Next" in the business of automotive service and collision repair.

"We've been listening to our members and asked for their feedback on what they liked and felt would improve their association," said Ray Fisher, ASA's executive director. "One message that came through loud and clear was a desire to hear more about what ASA is doing to advance the service and repair industry.

"The podcast format was quickly identified as the way many liked to receive this type of information quickly, easily and

>> ASA CONTINUES ON PAGE 6

TRENDING

SATA TOOLS LAUNCH IN THE UNITED STATES

Apex Tool Group has launched a new performance brand for U.S. auto techs: SATA Tools, available on Amazon. The line includes torque wrenches, pliers, ratchets, impact sockets and more.

MOTORAGE.COM/SATA

PEP BOYS EXPANDS WITH NEW SERVICE, TIRE CENTER

Pep Boys has opened new service and tire centers in Astoria, NY; Lawndale and Rocklin, Calif.; and LaGrange, Ga. as part of its continued national network expansion.

MOTORAGE.COM/CENTERS

INNOVA LAUNCHES APP, TOOL BUNDLE

Innova launched its RepairSolutions2 app and new line of WIFI and Bluetooth-enabled onboard diagnostic tools to help diagnose and repair check engine light-related problems.

MOTORAGE.COM/RS2

INTERVIEW TACTICS FOR A CULTURAL FIT

In this Remarkable Results podcast, get some human resources wisdom on your interview tactics, form and format that will help you build your bench and make quality hires that fit into your business culture.

MOTORAGE.COM/TACTICS

DRIVE EXPO SEES ATTENDANCE BOOST

DRIVE held its EXPO in late September with a record-breaking number of both attendees and industry sponsors. Two more workshops were announced for February and April 2020.

MOTORAGE.COM/DEXPO

>> **PILOT** CONTINUED FROM PAGE 4

quality and convenience at an affordable price. They will feature a unique look and feel, creating a differentiated offer that meets evolving consumer preferences in maintenance experience, convenience needs and digital choices, as well as sustainability considerations. Expansion of the workshop network beyond the initial test phase will be decided after the completion of the pilot programme.

The operation of existing Castrol and Bosch branded workshop networks will not be impacted by these pilots.

"As a leading global automotive supplier and expert in technical diagnostics and workshop concepts, Bosch has successfully offered high-quality automotive products and services for workshops and car drivers for many decades. Together with Castrol, our two leading brands will join forces for a new workshop concept to serve today's and tomorrow's market needs, and to reach more business partners and drivers. This new offer pursues our goal of providing our customers with a comprehensive, future-oriented range of mobility services for various kinds of vehicles," said Manfred Baden, president of Bosch Automotive Aftermarket.

Commenting on the partnership, Mandhir Singh, Castrol CEO said "At Castrol we have developed a deep understanding of the workshop aftermarket. We are committed to leveraging our long-standing expertise in innovative lubricants technologies, brand and marketing, digital and consumer insights to develop sustainable workshop businesses built around value-adding consumer experiences. We are delighted to see this vision shared by our partner Bosch, with their complementary values in technology and channel management. The outcome of the pilots will help us create a leading workshop network for the future."

Bosch Automotive Aftermarket and Castrol began working together in 2013 with a mutual recommendation agreement in Europe. This successful cooperation set a solid foundation for both companies to look at other ways to work together in the rapidly evolving automotive aftermarket.

>> **ASA** CONTINUED FROM PAGE 4

cost-effectively to complement our current ASA app, social media and online information resources."

The ASA Podcast series premiered with an interview of Jeff Buckley of My Father's Shop Certified Auto Repair in Midlothian, Texas, and Frank Leutz, of Desert Car Care in Chandler, Ariz., two ASA member-shops owners who have embraced some of the latest communication technology to engage the industry and consumers. Their thoughts and comments not only explain the value of this type of outreach, they offer listeners a blueprint for getting involved themselves.

"I've heard podcasting is the new blogging," Molla said. "I have been a communicator my entire career. Having worked with both print and electronic media, the ASA Podcast is the natural evolution of what's next in our outreach efforts.

"Jeff and Frank represent what's next in using the capabilities of all types of social media to drive business and improve engagement with their customers and colleagues. They represent the many ASA members who don't just make a living, they make a difference!"

The ASA Podcast series will serve a variety of uses, Fisher said.

"Beyond the primary purpose of delivering information in a convenient, audio format that can be enjoyed while driving or accessed 24/7/365 through a smartphone," Fisher said, "we see this podcast capability as something our Affiliates can use as a cost-effective way to promote their events, record panel discussions, and spotlight ASA members in their local areas, just to name a few possible applications."

Fisher said Molla is already coordinating with ASA's Washington, D.C. representative Bob Redding about using the ASA Podcast to deliver timely, legislative news and information to ASA members and aid our advocacy efforts at the state and national levels.

"With cybersecurity and data access being two large concerns, I believe this will enhance our way to keep the industry informed, and with Tony's skillset in this area, we're taking ASA to a new level," Fisher said.

The weekly ASA Podcast is available on Apple, Stitcher, Spotify, Google and Amazon Alexa, or wherever you access your podcasts.

"Our first podcast with Jeff and Frank is longer than what future ones will be, but we had two individuals sharing their wisdom and I didn't stop them!" Molla said. "The typical ASA Podcast will be about 10-15 minutes long. We plan on offering a variety of content that will vary in length.

"The ability to listen and learn, hear what others are doing to meet challenges, or just stay informed was high on the want list in the feedback we received. We believe the ASA Podcast will help drive better engagement with our existing members — and those who are thinking about joining ASA — to become more involved in their industry. At the end of the day, ASA is all about serving its members, and our new ASA Podcast series is designed to check all the boxes. It really is what's now, what's new and what's next in itself."

DIAGNOSTIC INTELLIGENCE

AUTEL UPDATES PROVIDE LATEST OE-LEVEL COVERAGE FOR US / ASIAN / EUROPEAN VEHICLES (1996+) INCLUDING SUPERCARS

MAXISYS MS906TS 8”

- Bi-Directional Control
- **Most Affordable Pre/PostSCAN**
- **Complete TPMS Service**
- 1YR FREE Software/1YR Warranty

8” | 1024x768 LED Touchscreen | 1.3GHz-1.7GHz Hexa-Core | SSD 32G Memory 2G RAM | 10,000 mAh Lithium-polymer | 8MP Camera | 4.4.2 Android OS

MAXISYS MS908S 9.7”

- Bi-Directional Control
- Advanced Coding & Adaptations
- **64G On-Board Memory**
- 1YR FREE Software/1YR Warranty

9.7” | 1024x768 LED Touchscreen | 1.3GHz-1.7GHz Hexa-Core | SSD 64G Memory 2G RAM | 11,000 mAh Lithium-polymer | 8MP Camera | 4.4.2 Android OS

MAXISYS ELITE 9.7”

- Bi-Directional Control
- Advanced Coding & Adaptations
- Docking/Charging Station
- **2YR FREE Software/2YR Warranty**

9.7” | 2848x1536 LED Touchscreen | 1.8GHz Quad-Core | SSD 32G Memory 2G RAM | 13,600 mAh Lithium-polymer | 8MP Camera | 4.4.4 Android OS

MAXIIM IM608 10.1”

- Bi-Directional Control
- Advanced Coding/ECU Coding
- **XP400 Key Programmer**
- **MaxiFlash JVCI/ECU Programmer**
- 64G On-Board Memory
- 1YR FREE Software/1YR Warranty

10.1” | 1920x1200 LCD Touchscreen | 1.3GHz-1.7GHz Hexa-Core | SSD 64G Memory 2G RAM | 15,000 mAh Lithium-polymer | 8MP Camera | 4.4.2 Android OS

MAXISYS MS908CV 9.7”

- Bi-Directional Control
- Advanced Coding & Adaptations
- J2534 MaxiFlash Elite
- New Deutsch 6-Pin & 9-Pin Probe Set
- **Heavy Duty Class 1- Class 9**
- 1YR FREE Software/1YR Warranty

9.7” | 1024x768 LED Touchscreen | 1.4GHz Quad-Core | SSD 32G Memory 2G RAM | 11,000 mAh Lithium-polymer | 5MP Camera | 4.0.4 Android OS

You're wrong — cars simply don't matter

People and labor should be your true focus for continued success

This may sound crazy, but like it or not, you are not in the car business. Let's listen to veteran ATI Coach Geoff Berman explain what he means by that statement:

Think about it. Has a car ever driven up to your front counter all by itself, looked you in the eye and said, "I'm here for my 8:30 oil service?" Have you ever seen a car pull up to a traffic light and turn to the car next to it and say, "Hey, dude, you have to go to Jim's Garage!" Cars don't have feelings or emotions, and they don't make the decisions on the services they buy. This is not a Disney movie.

So what business are you in?

If you are thinking you are in the service business, you wouldn't be wrong. The problem is that the service part of your business is only half the picture. There are two kinds of people who come to your business.

First, there are the people who trade their dollars for your service. These are the ones you think of when you relate to being in the service business and you call them your customers. The problem is that you tend to see customers as the ones who are most important to your business. I say we are putting the cart before the horse here.

IF YOU EMBRACE THE IMPORTANCE OF TRAINING AND YOU MAKE YOUR TRAINING COMPLETELY ABOUT "PEOPLE" AND "LABOR," YOU WILL FILL MORE OF YOUR LABOR INVENTORY EVERY SINGLE DAY.

The other group of people who come to your business are the ones who trade their service for your dollars. You typically refer to these people as your employees. Employees are just as important as customers. Employees provide the service experience that you want customers to have. Therefore, you should be more engaged with your employees to ensure they provide the expected experience to customers needing vehicle service. You can no longer ignore your employees and assume that because they get paid, they will always do the right thing. So instead of thinking you're in the service business, look at it as you're in the "people business." Realize that all people matter. Not just customers.

Do you really know what you sell?

If you take a moment and consider the products and services you sell, the top three that come to mind are probably parts, labor and sublet. For most, the top two are parts and labor with sublet a far distant third. Of these top two revenue categories, you can boil them down to one that really matters. Without this one, the business cannot survive. In case you haven't guessed it, it's labor. What you sell is labor. Without it you're nothing but a parts store.

Have you ever had a day where the place was insanely busy? You knew it had to be a great sales day. Then you looked at the deposits for the day and couldn't believe how little was there.

On the other hand, have you had a day where it felt like you hardly worked? The work flowed smoothly and efficiently. As a result, you had great deposits that day, but it didn't feel like you should have. Usually when I hear about these great days the shop owners tell me: "We had the right jobs. Everything just fell into place." My answer is always the same: "Do you want that every day? The solution is to focus on labor."

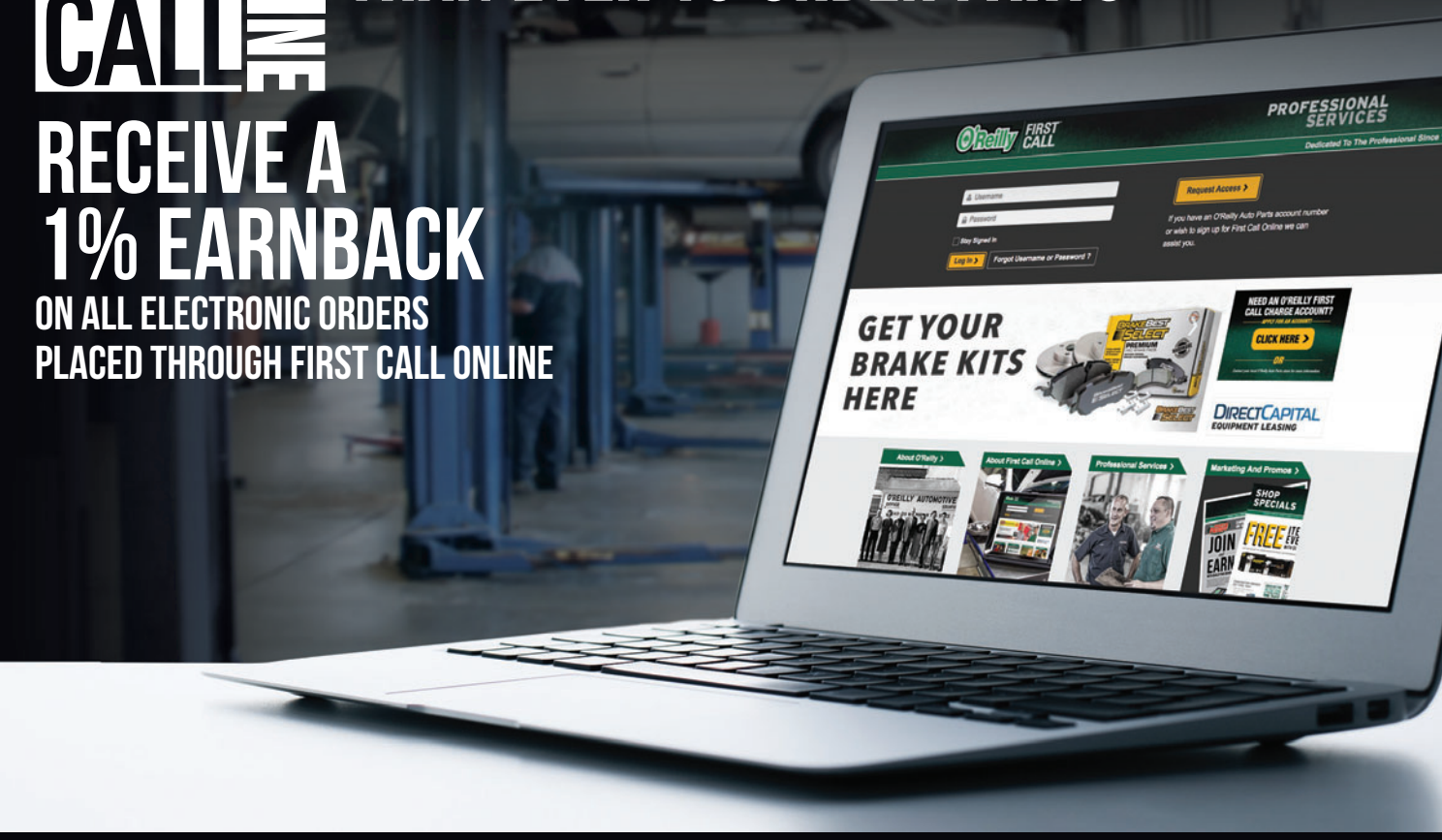
If every car that came in only purchased an oil change, I think you would agree it would likely create an extremely

FIRST CALL ONLINE

MAKING IT FASTER AND EASIER THAN EVER TO ORDER PARTS

RECEIVE A 1% EARNBACK

ON ALL ELECTRONIC ORDERS
PLACED THROUGH FIRST CALL ONLINE



FIRST CALL ONLINE IS A COMPLETE, INTERNET-BASED ELECTRONIC CATALOG DESIGNED EXCLUSIVELY FOR THE PROFESSIONAL.

FAST & EASY PARTS ORDERING
Look up parts and place the order in seconds

REAL TIME PRODUCT AVAILABILITY
Find the parts you need from your store, surrounding stores, hub or distribution center

E-PUBLICATIONS
Flyers and exclusive professional publications are just a click away

ONLINE PROMOTIONS
Access Parts Payoff and First Call Promo for additional rewards

BILLING STATEMENTS
View and print past and current billing information

ONLINE ORDERING EARNBACK
Earn 1% back on qualifying electronic purchases

FIRSTCALLONLINE.COM

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

AVAILABLE EXCLUSIVELY AT
O'Reilly FIRST CALL
DEDICATED TO THE PROFESSIONAL
FirstCallOnline.com

ADV 1479

busy and unprofitable day. That would be a shop focused on cars. The opposite is also true. If every job that day was an engine job, your "C" tech would have very little to do, and again, you would find yourself not making any money. The cars simply don't matter. It's the labor that does. Focus on the labor, and the cars will always follow. Focus on the cars, and the labor won't be consistent. The biggest fix for this problem is adopting proper scheduling techniques that aim for the results you're trying to achieve. Remember, where you finish your day has a lot to do with where you start your day.

How do you get all of this done?

Now that you understand the importance of people and labor, you're probably wondering how to make this a priority at your shop. There are many things to consider, but training should be No. 1. You must become a training company, and every staff member must understand that you're a training company, period! If you embrace the importance of training and make your training completely about "people" and "labor," you will fill more of your labor inventory every single day.

Take a courtesy check for example: is it about people or labor? If you said both, you're right. It builds trust with your customers and sells more labor. What about thank-you calls: is it people or labor? People, right? Who doesn't like a sincere thank you? And last, what about exit appointments: people or labor? You can easily see how it impacts both. Examples of other services that affect both categories are customer walk-arounds, proper road testing before and after the service, proper parts handling and quality control processes. They all impact people and labor.

Never forget this!

Nothing I said here matters if you don't understand the importance of communication — communication equals production. If you have strong production, you have strong communication. There is a direct link between communication and overall production. Often, shop owners tend to look at the technician as the production issue. While that may be part of the case, more than likely there are many factors at play here that the technician has very little or no control over.

If the customer does not respond to the sales call for three hours, what does that do to production? It's easy to blame the customer. However, what if you pointed your finger at yourself instead? What if everyone did that? Instead of immediately blaming the customer, ask yourself and your staff, "What can we do to improve communication with our customer . . . how can we guarantee they will be there when we call?" Questions like this encourage ideas, not excuses. You might discover answers like this: tell the customer we are going to call them between 10 a.m. and 11 a.m. to review what the vehicle needs, and remind them that this conversation ensures the best chance they'll get their vehicle back today.

What about how you communicate with the parts suppliers? Do you open the packages and look at the parts while the driver is still standing there, or do you wait until you are ready to install them? How you communicate with the parts suppliers impacts production, too.

What about the estimate itself? Does your service professional review the estimate with your technician before the customer is called? If they did, wouldn't the chance of time being missed on the repair order be less likely and could turn a three-hour job into a four-hour job? How you communicate with your technician impacts production also. What you sell is labor!

Conclusion

There are five rules you need to remember if you want to get everyone focused on the same goals:

1. Cars don't matter. If you focus on labor, the cars must follow.

2. You're in the people business. Employees are more important than the customers. This will guarantee the customer is taken care of exceptionally.

3. What you sell is labor. Labor is the glue that holds it all together. When you sell labor, parts will almost always follow.

4. Y**ou're a training company.** Make sure training is a No. 1 priority and that it reinforces prioritizing people and labor. Be constant and relentless in how you train.

5. Communication = Production. How you communicate with everyone impacts production, which impacts labor. Always ask yourself and your staff how communication can be improved. There is always a way to make it better.

Are you controlling your day or is your day controlling you? If you're tired of reacting to issues and putting out fires daily, then you're probably failing to plan appropriately. Discover if your planning skills need improvement with the Scheduling Blueprint Checklist. Use this tool to help you adopt effective scheduling techniques that aim for the results you're trying to achieve. Simply go to *www.ationlinetraining.com/2019-11* for a limited time. Remember, where you finish your day has a lot to do with where you start your day.

CHRIS "CHUBBY" FREDERICK is the CEO and founder of the Automotive Training Institute. ATI's 130 full-time associates train and coach more than 1,500 shop owners every week to drive profits and dreams home to their families. Our full-time coaches have helped our members earn over 1 BILLION DOLLARS in a return on their coaching investment since ATI was founded. This month's article was written with the help of Coach Eric Twiggs.
chubby@autotraining.net

THE VENDOR SAID THEY WOULD STAND BEHIND THEIR PARTS. BUT ONLY THOSE BIG ENOUGH TO HIDE BEHIND.

What kind of profit is there in fluid services?

Check your internal shop process to ensure profit isn't falling through the cracks

The industry is aware that fluid service is a very important part of the vehicle today, however, I am still amazed how under-equipped shops are to properly service the various fluid categories on a vehicle.

Consider the basic fluid services required today for proper and professional vehicle service — namely, system flush, carbon clean, oil flush and a transmission flush to start. All require specific equipment to perform the service professionally and all should be in the bays of a modern shop today.

What goes missing in the conversation is the profitability contribution each service can make to the shop.

Let's examine a transmission flush as an example. Fill in your own numbers. Mine are low on purpose, as I'm just using an example to show you the format. When you fill in yours, you will be amazed at the profit potential:

Filter & Gasket

- Shop Cost: $19.12
- Shop Retail: $38.24
- Gross Profit: $19.12

Transmission Fluid, 12 quarts

- Shop Cost: $26.72
- Shop Retail: $53.44
- Gross Profit: $26.72

Labor (1.7 x $28 wages)

- Shop Cost: $93.44
- Shop Retail: $191.67
- Gross Profit: $98.23 (51 percent)

Also consider:

- Purchase price of the equipment is approximately $5,000
- Lease cost of equipment estimated $170 per month X 12 months = $2,040 or 1.7 flushes per month ($170 divided by $98.23GP)
- Recommended transmission flush every 50,000 miles
- Based on 600 clients averaging 11,000 miles/year
- (600 X 11,000 miles)/50,000 = 132 flushes X 98.23 = $12,966.36
- $12,966.36 less the annual lease cost of equipment ($2,040) = Additional Net Income of $10,926.36

WE ARE MISSING INCREDIBLE OPPORTUNITIES. IT HAS NOTHING TO DO WITH GETTING NEW CUSTOMERS/ CLIENTS; IT HAS EVERYTHING TO DO WITH PROPERLY AND PROFESSIONALLY SERVICING OUR CURRENT CLIENT BASE ALREADY COMING THROUGH THE DOOR.

Now keep in mind, while the machine is performing the service, the technician is also performing other work on the vehicle, so in reality, the total gross profit for the hour rises dramatically, and the "efficiency" of the technician also dramatically improves.

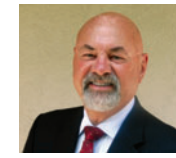
Do the same format analysis on each of the other fluid services and I think you will find the potential for Net Income with them all combined is over $100,000 per year based on a client base of 600.

In reality, the question that must be answered is how many services should we be performing per year from each fluid service in our shop based on our actual client base? If the math says, based on our client base, that we should be performing 135 transmission flushes (from example above), but we only did 68 last year, what is wrong with our internal shop processes? We are missing incredible opportunities. It has nothing to do with getting new customers/clients; it has everything to do with properly and professionally servicing our current client base already coming through the door.

Review the internal shop processes as to how the vehicle is inspected in your shop. Is accountability for the inspection in check? Are the service intervals being placed by calendar date for future client contact based on the mileage the vehicle is driven? If the service is deferred, is it being followed up properly?

Management's role is to ensure all the right processes and checks and balances are in place so that nothing falls through the cracks. Proper vehicle servicing of all fluids is but one area where each shop should be doing a full review.

The math does not lie. How much is your shop missing per year?



BOB GREENWOOD, AMAM, is president and CEO of Automotive Aftermarket E-Learning Centre Ltd. (AAEC), which provides business management resources for the automotive aftermarket. Bob has more than 36 years of business management experience and is one of 150 worldwide AMi-approved instructors.
greenwood@aaec.ca

Installing confidence. Yesterday. And today.

Since the earliest days of the automobile, SKF has been supplying the world with the highest quality drivetrain, engine and wheel end components available. Today, SKF continues to provide high quality products and premium services to car and truck manufacturers, technicians and distributors across North America and around the globe.

Install confidence. Install SKF.

Visit www.vsm.skf.com to learn more

SKF®

Review of consent decree highlights need for reforms

Policymakers should focus on small business and consumers

The U.S. Department of Justice is reviewing a proposed termination of a judgement in United States v. Association of Casualty and Surety Companies, American Mutual Insurance Alliance and the National Association of Mutual Casualty Companies from 1963, more than 50 years ago. In recent years, this has been referred to as the 1963 Consent Decree and the focus was an Independent Appraisal Plan or Automotive Damage Appraisal Plan, which many view as a precursor to today's direct repair agreements (DRPs).

The Automotive Service Association (ASA) saw some correlation with this 1963 decision and a subsequent, new insurer program proposal in the mid-1990s. ASA leaders met with the top litigators at the U.S. Department of Justice (DOJ) to discuss the issue. DOJ was not encouraging as to the applicability of the 1963 Consent Decree to DRPs. ASA followed with multiple discussions with the antitrust policy chief at DOJ with similar results.

In an effort to exhaust the issue, ASA held public discussions in Washington, D.C. and during NACE in Chicago. Important for these public meetings, ASA included antitrust counsel from the U.S. House Judiciary Committee, consumer group representation, outside antitrust counsel and others to discuss and answer questions relative to the applicability of the 1963 Consent Decree to insurer-repairer issues of the day.

ASA has recently discussed DOJ's Consent Decree review with the leadership of the U.S. Senate who has contacted DOJ about the issue. DOJ has not made a final decision on whether to terminate the judgement or not.

Whatever the outcome of the DOJ review, several observations are important for collision repairers. First, if the decision is to keep the judgement in place, what happens next? Several previous reviews by democratic administrations demonstrated no encouragement for the Consent Decree resolving collision industry issues. Will this change in a republican administration? Finally, and most importantly, none of this addresses the insurer-repairer-consumer issues of today.

There are numerous collision repairer concerns that can be resolved today by policymakers who desire to help small businesses and consumers including the elimination of Most Favored Nation clauses in direct repair agreements, mandating the use and payment for OEM repair procedures, and others. These are real issues that impact collision repairers and consumers each day and are issues that can be resolved via industry dialogue or legislation. Legislation continued to struggle during the 2019 state sessions with the passage of New Hampshire House Bill 664, set to lead the way for OEM repair procedure legislation, only to have New Hampshire's Governor Chris Sununu veto the bill. Although the legislature came close to a veto override, at the end of the day they fell short. The Governor's veto message included the following: "This bill would increase the cost of auto insurance premiums by limiting the ability of insurers to negotiate what is reasonable in the repair process. The requirements outlined in this bill would introduce a significant disadvantage for smaller independent repair shops and could limit their ability to compete. This limits consumer choice and raises insurance rates without the corresponding increase in safety for our citizens."

There are several messages in the Governor's statement, i.e. limitations on insurers' negotiating position; impact on smaller shops for making recommended, safe repairs; limitations on consumer choice; and insurance rates rising. All of these are indicative of the policy gap between consumers, repairers and policymakers as well as the amount of work necessary to bring these issues to resolution. As industry leaders, ASA and coalition partners will continue to strive to resolve today's issues.

ROBERT REDDING is the Automotive Service Association's Washington, D.C. representative. He has served as a member of several federal and state advisory committees involved in the automotive industry. *rlredding@reddingfirm.com*

PARTSOLOGY.com

Your #1 Source for

engine parts and more

Balance Shaft Bearing Sets, Brass Freeze Plug Sets, Camshafts, Camshaft Bearing Sets, Valve Lifters, Cylinder Heads, Head Gaskets, Head Shims, Engine Master Rebuild Kits, Engine Re-Ring Kits, Engine Overhaul Gasket Sets, Lower Gasket Sets, Engine Valves, Valve Guides, Valve Stem Seal Sets, Head Gasket Sets and Head Bolt Sets, Main Bearing Sets, Rod Bearing Sets, Thrust Washer Sets, Manifold Gaskets, Individual Gaskets, Seals, Oil Pan Gaskets, Rear Main Seals, Oil Pumps, Oil Pump, Repair Kits, Timing Covers, Piston Sets, Piston Ring Sets, Piston Pin Bushing Sets, Rocker Arms and Shafts, Timing Belt Kits,Timing Belt Water Pump Kits, Timing Belts, Timing Belt Adjusters Idlers Tensioners, Timing Chain Kits, Timing Cover Gasket Sets and Seals, Valve Covers, Valve Cover Gasket Sets, Variable Valve Timing (VVT) Solenoids and Sprockets, Power Steering Pumps and Reservoirs, Electric Fan Clutches, Water Pumps, Harmonic Balancers, Intake Manifolds, Motor Mount Kits.

QUESTIONS?
TOLL FREE 1-844-800-6866
HABLAMOS ESPAÑOL

ORDER BY 4PM GET YOUR PARTS TOMORROW!
LARGEST SELECTION OF ENGINE PARTS
ORDER ONLINE! OR CALL US

BBB ACCREDITED BUSINESS
BBB Rating: A

NEXT-DAY DELIVERY ON MORE THAN 3,000 ENGINE REBUILD KITS AND INDIVIDUAL PARTS! Professionals recommend Partsology.com for OEM Quality Parts for cars and trucks.

www.partsology.com

UNDERSTANDING BEHAVIOR PATTERNS

The dos and don'ts of maximizing technician and service advisor production

JEREMY O'NEAL // Contributing Editor

It was a bright sunny Tuesday morning on the Southern California coast; the ocean was a perfect temperature and the waves were epic. Jim sat on his surfboard soaking in this special moment, as he had the beach and the ocean to himself. Jim loved surfing on Tuesday mornings because everyone else was at work — he had worked hard to get to this moment. During the past seven years Jim had been through 17 service advisors; there just seemed to be a shortage of good help these days. His goal was to build an auto repair shop that would allow him to make a nice six-figure income and give him the time freedom to go surf on Tuesday mornings. Prior to this moment, every attempt at a Tuesday morning session would end in failure. There were the 1-star reviews, the upset customers, the calls from a technician complaining about the advisors, the calls from the advisor complaining about the technician, and it all seemed to boil down to one thing: poor communication. This would then lead to a lack of production and eventually poor financial performance for the business. Until one day Jim discovered the universal truths behind the dos and don'ts about maximizing technician and service advisor production.

Service advisors and technicians are human beings. In order to get results in work and life, all people utilize a behavioral strategy. Understanding that you are dealing with multiple personalities and deep-rooted behaviors is the first key to success. Each person on your team has unique talents, abilities and their own set of behaviors they have learned throughout their life to generate the results that have made them successful. Successful shop owners and managers understand how to identify each team member's unique behavioral approach and put them in the right position that enhances their natural talents. Jim discovered a system that allowed him to put his auto repair business on auto pilot. Here are the six keys Jim discovered that can help you and your shop become a profit generating machine!

1. Meet with each person individually. When Jim observed his team in action, he discovered there was friction between team members. At one point, the negative atmosphere was so bad Jim sent everyone home for the day and locked the doors to the shop. The next day Jim came in and invested his time in meeting with each team member individually. The goal of the meeting was to help Jim understand what is important to each person. Through careful observation, Jim discovered that each person

PHOTO: EPOXYDUDE / GETTYIMGAES.COM

www.VDO.com/USA

Cars are happy to see VDO OEM Direct Parts.

VDO OEM Direct Parts are genuine OEM parts direct from the manufacturer – that's us! They're the same high quality original equipment parts manufactured by Continental, affordably priced to keep you competitive.

We offer exceptional coverage for air control valves, electronic throttle valves, flex fuel sensors, fuel modules, fuel injectors, temperature controlling water pumps, door lock actuators, MAF/MAP sensors, wheel speed sensors, and washer pumps.

Why settle for parts that claim to be OE quality when you can have the genuine OEM parts?

salessupport-us@vdo.com
800-564-5066

OEM DIRECT PARTS

VDO

on his team has unique wants and desires. During the meeting, Jim asked thought-provoking questions:

- Why do you like working here?
- What do you like about your job?
- If I could help you achieve something in your personal life in the next 12 months, what would that thing be?
- When would you like to retire? What type of retirement would you like to have? How can our shop and your job help you achieve that? Do you feel like we are making progress towards that now?

After two full days of meetings with his team members, Jim was exhausted and excited! He learned so much about his employees and their personal goals. Jim felt closer to each person and vowed to utilize his time, effort and expertise to help each of them reach their own personal goals. That was the turning point. The moral in the shop changed immediately as each person on the team began to elevate their performance in order to reach their own personal goals and team goals. Each person knew exactly what they were working for!

2. Eliminate verbal communication. Jim began tracking and identifying the mistakes in the business that stole profits from the bottom line. What Jim discovered was a common factor that led to mistakes. Verbal communication. When Jim analyzed comebacks, upset customers and anything negative triggering, he discovered verbal communication was at the root of the problem. Many times, a service advisor would tell a technician to do something on a vehicle, the technician would perform the work and do what he or she was told; however, there were other items that needed addressing on the vehicle that were written on the repair order and they got overlooked. When the customer came in to pick up the vehicle, the major part of the job was done, but the taillight, the windshield wiper, the sticky door would be left undone and the customer would be upset. This then created a panic at the last moment and the shop looked like a hornet's nest that had just been hit with a baseball bat. Everyone was running around trying to fix the oversight. Jim decided that his customer deserved better than this and vowed to build a better system and eliminate the mistakes caused by relying solely on verbal communication.

3. Build a solid written communication system that eliminates oversight and mistakes. There is power in the written word! The repair order holds the key to success for your shop! Jim made a policy change and helped each employee understand how to read the repair order. The promised time on the repair order was understood as a promise to the customer. Every client concern was written down as a separate job or labor line, even the smallest request. Over time, the mistakes that were created by verbal communication disappeared and the team began to fire on all cylinders and execute to perfection. The technician's productivity rates soared as they eliminated time wasters and unproductive actions.

4. Huddles are the key to engagement and effective execution. The team began to meet twice a day to gain an understanding of what was expected. Yes, there is a time for verbal communication, and it pays huge dividends. Morning huddles were utilized to help each technician understand what priorities the service office had for the day, review of incoming appointments, provide a platform for discussion of any roadblocks in production or diagnosis, and build team morale. At the end of the day the team would meet briefly before locking up to review the wins from the day and to plant the seeds of tomorrow. Jim could see the results of helping the technicians begin to plan their work a day in advance by reviewing the workflow plan for the next day; hidden obstacles would get caught early and the team was prepared to execute.

5. Speed – Learn to work in an efficient manner. Jim began to lead by example. After all, his goal was to go surf on Tuesday morning. Jim bought a pair of ugly running shoes and began wearing them to work. When the team would ask him about his shoes, Jim replied with "Oh, these? These are for running. I can get more done if I run around instead of walking." Jim began run-

ning from his car to his office, if he helped a customer, he would run out to the car to get the information. Running is a powerful metaphor, and it began to catch on; his team began to move and work with purpose. There were two other items Jim began to focus on with production:

- **SOS – Speed of service.** How long did the average service take? How do we get faster? How do we get better? Jim would review the average speed of service KPI with his team every day.
- **ATR – Actual time of repairs.** Through effective communication, the team created a new metric. The technicians would estimate how long a job would take them to complete. The advisors would track this and together the team would work on hitting this target. This helped the service advisors create accurate promised times and they now had a system for under promising and overdelivering.

6. If it's not perfect, it's not right! Robert Hight of John Force Racing lost his first Funny Car Championship in 2008. The championship was in sight, and Robert was one race away from hoisting the trophy. When describing the moment, Robert talks about being ready for the moment and how time stood still; he knew he was going to win the race and the championship. The cars were staged, and they took off down the track. Robert nailed the start and was in the lead. He had a huge smile on his face, as he knew he was going to win… until something in the engine came apart, leading to a dramatic fireball and costing Robert the win and ultimately the championship. What is tragic about this story is that it could have been prevented. The cause of the failure was determined to be a 30-cent clip that was left off by a crew member. It was at this time that Robert and the team vowed to return next year and dominate the competition. In 2009, they did just that and they secured Robert's first championship, taking the motto "If it's not perfect, it's not right" every step of the way. What would happen if everyone in your shop adopted this motto and stuck to it every day? If every person involved in the customer experience worked with this mindset, it would change the quality of the experience and the finished product we deliver. It helped John Force Racing turn a defeat into a championship and it might just help you surf on Tuesday mornings.

JEREMY O'NEAL is a long-time industry trainer, and founded Advisorfix in 2010. He is currently president and lead sales trainer, and owner-operator of Freedom Auto Repair. *jeremy@advisorfix.com*

Bluewater vista

Genuine passion for cars drives Colorado shop's success

ROBERT BRAVENDER // Contributing Editor

Many business ventures start with passion, although most endeavors in the 21st century seem dominated by three Cs: capability, cooperation and capital. During an industry's halcyon days, maybe — but as little as eight years ago Bluewater Performance accomplished this feat driven almost exclusively by a passion for performance.

Specializing in European auto repair, this Denver, Colo., business started out as a speed shop in Gabe Adams' garage. As a kid in Cincinnati, Ohio, Adams had grown up helping his dad build Chevy street machines, but at 16 bought a '96 Volkswagen Jetta as his first car.

"Even though it was bottom-tier VW, it just had a different feel to me than a Chevrolet or any domestic vehicle," Adams recalls. "The way it was put together, how it drove; it just all seemed to be a different world to me."

As a Colorado resident, he went from tinkering to tuning and soon had the Jetta impressing friends in the local car scene with its performance. Before long they were bringing their own performance rides to Adams.

"With four to six cars in front of my house and in the driveway, it got to the point where I knew I could not sustain that for much longer; I had to do something," he notes. "The fear of having a $500-$600 a month single bay garage rent payment kind of terrified me — but I decided to do it anyway."

It was a rough start; that first facility was hidden behind a concrete business, and the first year or two he worked full time at another job, going to the shop at night. But eventually Adams deemed his little venture sustainable and left what he described as a good-paying gig to dive into Bluewater.

"At the same time I knew that I didn't have the money to develop this great marketing plan for the business, where I could branch out into all this repair and maintenance stuff," he explains. "If I all of sudden opened up as another generic repair shop, I'd be competing against 10,000 other shops without any reputation to distinguish me."

So Adams decided to build that reputation from the ground up. "I focused on not just a single brand, but a single model: the Volkswagen R32," he continues. "I decided to perfect how I did performance tuning, upgrades and repairs on it; there wasn't going to be anyone better in the country than me on this single vehicle."

BLUEWATER PERFORMANCE
Denver, Colo. // bwperformance.com

Gabe Adams Owner	**10,000** Total square footage of shop
1 No. of shops	**7** No. of bays
10 Years in business	**45** No. of customer vehicles per week
8 No. of employees	**$2.5 million** Annual gross revenue

He gradually expanded with similar models, like GTIs and Jettas. "Then maybe three or four years into this, I decided to branch out to all-Audi, all-Volkswagen," eventually adding Porsche and BMW, Adams notes. "We started doing oil changes, tire rotations, alignments. By that point it was easy to get people from the performance side to be comfortable with us going into their vehicle to do simple maintenance and diagnostics."

Because one aspect of the European performance market is that these cars are frequently also daily drivers. "I would honestly say that these are close to 80-plus percent of the performance vehicles that we do," Adams estimates. "So it's extremely important that not only does the car meet customers' performance expectations, but that it's also extremely reliable."

Meanwhile, Adams was putting everything he had back into the shop. "For the longest time I lived as if I was broke, homeless," he laughs. "Alignment machine, tire changers, all-wheel

PHOTOS: BLUEWATER PERFORMANCE

LAUNCH TECH USA
CREATE • CHANGE

X-431 PRODUCTS
LAUNCH

ULTIMATE POWER!
MAXIMUM PERFORMANCE!

THROTTLE WORKS WITH HD ADD-ON TRUCK MODULE

INTRODUCING
THE THROTTLE & ADD-ON TRUCK MODULE

X-431 Throttle is the newly developed high-end comprehensive diagnostic equipment with charging base based on the Android 7.1 system, supports dual 5GHZ WIFI communication, has a wide coverage of models, strong diagnostic capabilities, accurate detection data and other characteristics.

The perfect storage for your ADAS calibration set & calibration targets.

X-431 ADAS CARTS

EACH ITEM SOLD SEPARATELY

THE FUTURE IS HERE!
DO THE REPAIRS RIGHT! KEEP THE REVENUE STREAM IN HOUSE!

X-431 ADAS, the Advanced Driver Assistance System Calibration Tool, was originally released by LAUNCH and can be used with Launch diagnostic tools.

X-431 ADAS
Throttle works well with the ADAS!

X-431 ADAS

X-431 ADAS SYSTEMS

LDW I Rear Collision Warning
AVM I Blind Sport Warning
ACC I NVS CALIBRATION

*Optional

PRODUCT FEATURES

- Easy to use Interface
- Military Tough Design
- Android 7.1 Processor
- Dual Band WIFI
- 2 hour Quick Charge Tech
- Bluetooth Technology
- 13 MP Rear Camera
- OBD 1 Kit Included

LAUNCH
1820 S. Milliken Ave. Ontario, CA 91761
1-877-528-6249
www.launchtechusa.com

dyno; it was never one big purchase, just as I could afford it. I want the latest and greatest, even if it's an A/C recharging machine; I want to offer the same things a dealership can."

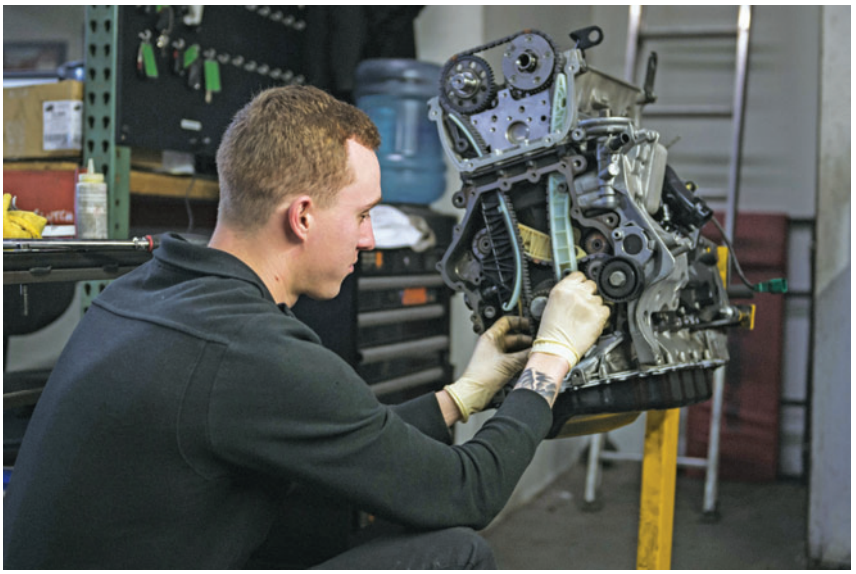
One tool that's helping achieve this goal has been the Shop-Ware program, management software, which "promotes business wellness, maximizes productivity and teamwork, and wins with customers by streamlining sales and bolstering…online reputation," according to their website.

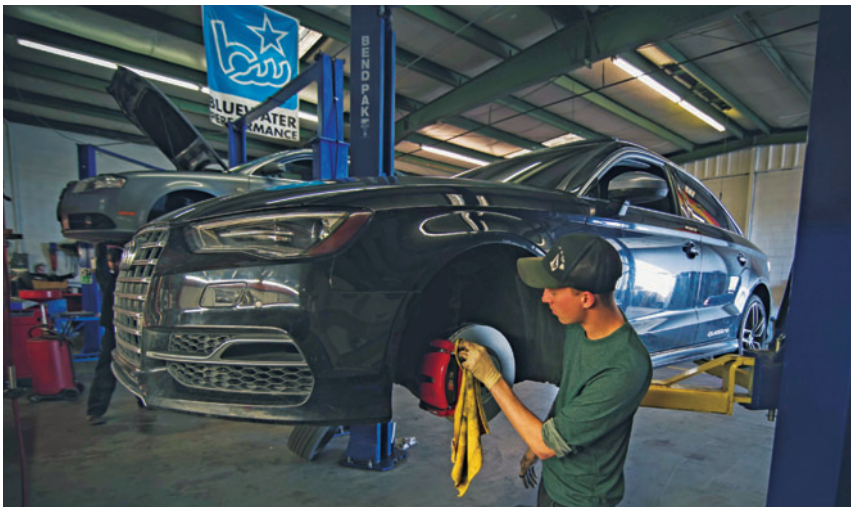
"I've always been using Google Calendar for scheduling and Quick Books for writing tickets," concedes Adams. "But (Shop-Ware) can text updates, send photos or videos directly to the customer; you don't have to take time out of your day to schedule a call. I can send estimates to your phone and you can approve it right then. Compared to what I was using before, all the external features from my company to the customer just exploded."

Shop-Ware also consolidated the shop's scattershot memos system. According to a Bosch press release, "all North American BCS (Bosch Car Service) shops receive access to tailored systems that can be customized to their needs, including customer access to job status, financial reporting, workflow management, technician productivity, estimating, online parts ordering through Parts Tech and more."

That "more" included Bosch selecting Bluewater Performance to beta test a program tying one of their scan tools into the Shop-Ware system. "A vehicle comes in, and I have one of my technicians scan that vehicle," explains Adams. "That entire scan automatically gets uploaded through Shop-Ware to the customer's profile, where they can see it. Now my techs don't have to print out the scan, hand it to the service writer, or find a way to copy it down as a PDF.

"That's something that is going to be





released I think either at the end of this year, or early next year, so anybody who has Shop-Ware and one of the Bosch ADS 625 tools, that automatic integration will be there for them at no extra cost."

For Adams, the performance of the shop itself has become his passion. "We have roughly 10,000 square feet and it's manageable," he notes. "It's very busy but not overwhelming. If anything, we might look into opening another location, but I'd have to make sure all my processes are perfect at this one before I think about that."

Bottom line: "we're enthusiasts," states Adams. Two of his employees race an Audi RS3 LMS they custom upgraded for the Pike's Peak hill climb. "We're trying to break a record in the front wheel drive class. We also go to car club meets, we're in the neighborhoods doing car-related stuff; we love doing this, and we want to help other people out with their passion for these cars."

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

ADVANCED BATTERY DRAIN DIAGNOSTICS

LET'S REVIEW SOME TIME-HONORED METHODS AND EXPLORE NEW METHODS FOR UNMASKING PHANTOM BATTERY DRAINS

DAVE HOBBS // Contributing Editor

A nominal amount of battery drain is present on every vehicle on the road once the vehicle is switched off and had enough time for its various modules to complete their "go to sleep" processes. The KAM (Keep Alive Memory) current draw for individual ECUs is typically around 1-3 mA per device. KAM is necessary for keeping both long-term and short-term memory alive for functions such as the vehicle's clock, DTC storage, telematics and module adapts, to name just a few. The number of ECUs has increased in recent decades, making the overall vehicle normal parasitic drain tally up to as much as 30 mA to 50 mA — the numbers that seem to be the unofficial max specs. For this reason, many OEMs have moved toward greater use of EEPROM to provide more permanent memory storage and improved power management to decrease battery drain. This has helped to lower the normal parasitic on many newer vehicles to as low as 5-10 mA in some cases. Factory battery saver devices at the battery or in the BCM along with automatic module power down algorithms during extended storage times have also contributed to aiding today's mobile electronic monstrosities in keeping their 12-volt starting batteries alive for storage periods of months at a time.

THE PHOTO ON THE LEFT SHOWS 0.5 ohms between the battery negative cable at battery post and ground wire to fender. The meter's leads connected (together) measure 0.4 ohms, so we have a good ground. Parasitic current draw was normal (18 mA). The photo on the right shows the same ground resistance measurement only with a moderate parasitic current draw of around 1.5 amps. 28 ohms of resistance? False reading tells you there is a drain! It's time to do a detailed parasitic current draw test!

Intermittent battery drain — the phantom!

Parasitic drains on newer vintage vehicles seem to be intermittent more times than not due to the complexities of data buses and modules staying awake when they should be asleep. The most complex modern vehicles, however, can still have old school drains that can run a battery down in a few hours or few days. Even a brand-new vehicle (non HEV/EV) has an alternator that can suffer from a battery-draining diode leak. Faulty door latch/door lock switches can cause drains, as can glove box and trunk light switches. The old trick of opening a trunk or glove box and grabbing the bulb to see if it's "two hours hot" or "two seconds warm" still works today just as it did 40 years ago. Ouch: this test still burns your fingers too...but at least you found the drain!

The following steps will help you unmask your next phantom battery drain.

Step 1. Make sure it's not something else. Document all DTCs in all modules. DTCs stored in modules after a battery drain are often "effect" DTCs rather than "cause" DTCs. Regardless, retrieve and document prior to clearing. Some DTCs that

PHOTOS: DAVE HOBBS

AN EASIER WAY TO GET YOUR BEARINGS (AND YOUR HUBS).

Finding the right hub-and-bearing assembly can be confusing. So Motorcraft® simplified the process by revising its lineup to greatly expand coverage. These units are competitively priced and fit many older vehicles. See your local dealer or distributor for all the details.

Ford Motorcraft®

Right part. Priced right.

A CALIBRATED QUALITY INDUCTIVE AMP CLAMP with jaws large enough to encircle the battery cable(s) coming off either battery post in the hands of an above-average tech is great. That holds especially true when attempting to scope the drain over time. Many of us will get in a hurry, however, and make the common mistake of not correctly converting 1 mV/100 mV measured at the scope or DMM into actual mA. The same holds true for those who use a shunt resistor in series with the battery cable to measure mV of voltage drop. An extra decimal point in either direction can make or break an accurate diagnostic decision!

PHOTO: PICO TECHNOLOGY / AES WAVE

THE FLUKE 87 DMM AMMETER wired in series across a battery disconnect switch (400 mA ammeter scale used) is displaying 08.66 mA. The most accurate inductive amp clamp/DMM I own with large enough jaws to accommodate multiple battery cables is showing 00.03 A. That's 30 mA, which is a huge difference from the actual 8.66 mA. My advice is to use a quality ammeter in series as pictured!

BATTERY MEMORY SAVER/DLC ADAPTER. Connect to a 12-volt boost box to keep vehicle alive during ammeter connections. Old style 12-volt accessory plug style (cigar lighter) memory savers don't work anymore, as many are disconnected from B+ when the vehicle is off.

return may be good clues, especially if they are U-codes (communications related) as we'll see later. ALWAYS test the battery and charging system prior to performing a parasitic battery drain test. Many times, the customer complains of a battery drain or "short" when the actual problem is a faulty battery or charging system problem. A battery with an intermittent shorted cell can sometimes mask itself as a phantom battery drain. If there are any doubts on the condition of the battery — replace it! An underperforming charging system (faulty or incorrect alternator, poor connections, an undersized alternator or slipping drive pulley) can lead to false battery drain assumptions as well. If the vehicle is a HEV, PHEV or EV, keep in mind there is a DC-DC converter that functions as an alternator. The same charging system tests complete with fully loaded electrical system conditions should be performed just the same as with a conventional mechanical alternator.

Step 2. False Ohms test — Prequalifying excessive parasitic current draws. DMMs (Digital Multimeters) read false resistance when you use their ohmmeter function on a live circuit. You can use this tidbit of knowledge to quickly judge whether an above normal amount of current is flowing out of the battery.

Try this test in your shop:

1. On a vehicle that has been sitting for an hour or more (all modules presumably asleep) connect an ohmmeter between the battery negative post/cable and a known good ground such as one of those short ground wires to a fender or radiator support. You'll probably see the predicted 0.2 to 0.5 ohms of resistance, which is mostly the resistance of your leads and alligator clips.

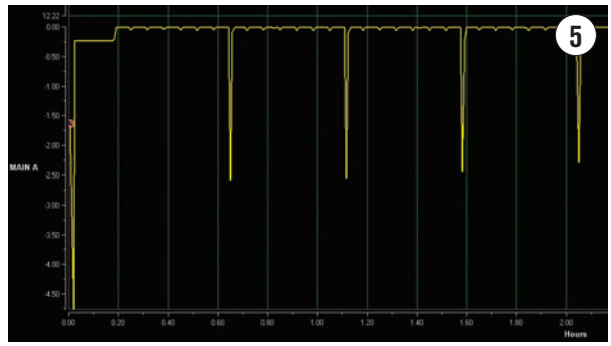
2. Open the door to allow the BCM to wake up/dome light to come on. You almost always see a "false resistance" of several ohms on your ohmmeter. Switch on the ignition and you'll see even more of this false resistance.

3. Turn off ignition, close the door and lock the vehicle with the keyless entry fob to speed up the sleep process. It may take several minutes, but you'll see that false resistance on the known good ground go back to the original minimal resistance you had to begin with (**Figure 1**).

Now that you've seen for yourself how this trick works, use it on your next vehicle with a phantom drain. Simply watch the ohmmeter. When extra ohms pop up, there is an above normal drain occurring at THAT moment. Catching the phantom drain in the act BEFORE running time-consuming and intrusive parasitic drain quantification and offending circuit isolation is the best way to avoid the frustration associated with unmasking the phantom.

Step 3. Keep the battery connected to "sneak up" on the phantom! The use of an ammeter connected in the typical fashion results in the battery being dis-

connected. One way to avoid that is to use an inductive amp clamp that converts the current draw to mV for conversion on a voltmeter or an inductive amp clamp self-contained DMM. There are a lot of inductive amp clamps out there on the market. I've found very few that have large enough jaws to fit around several battery cables AND is accurate down to a few mA (**Figures 2, 3**). So, if you really want to accurately know how many mA the vehicle is drawing, use an ammeter in series (**Figure 3**) with the battery cable on the lower amp scale (most are 400 mA). Powering down the 12-volt system to connect a meter or shunt resistor (for a voltage drop/amp draw conversion); however, is a Murphy's Law guarantee to make an intermittent excessive battery drain go into remission. Remission can sometimes last as longer than yours or your customer's patience. Why risk having the phantom drain go into remission? Avoid depowering the system by installing a 12-volt battery boost box powered memory saver at the DLC (**Figure 4**). This will keep the 12-volt system alive while you install a parasitic load test adapter (battery disconnect switch).



THE MIDTRONICS IN-GEN IDR-10 BATTERY DRAIN DATA RECORDER GRAPH displayed for this 2012 Chevy Malibu indicate each of these spikes is separated by a period of 28 minutes. This is normal — a result of the ECC pinging the IPC for data regarding outside air temperature. The average magnitude of these spikes is – 2.03 A. After the 4th and final spike, the current draw should return to the normal 10 – 20 mA draw.

Next, trip driver's door latch switch into the door shut position and jumper around any hood or other switches that are associated with gaining access to the battery and fuse panel(s). You are going to want to cycle the ignition on and off or drive the vehicle to get the phantom to appear so make sure you remember to close the parasitic load test adapter whenever cycling the ignition. Failure to do so will blow the fuse in your ammeter.

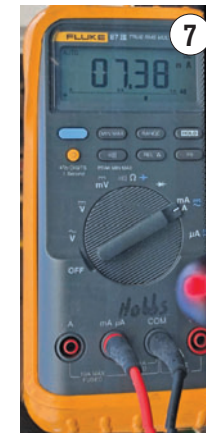
Step 4. Know what's normal. What really happens with the vehicle's battery drain over the course of several hours of key off time? Try this experiment. The next time you find yourself waiting in a vehicle for 30 minutes or more, try turning off the key and sitting in silence. Listen to what goes on. You'll likely hear some activity. The occasional relay click and buzzing sound of the vehicle's final checks on air suspension trim height, an EVAP leak pump/vent solenoid, HVAC doors cycling or even a short series of HVAC after-blow blower runs to prevent evaporator odor. While you may not hear these actions during your normal workday in a noisy shop, those activities are going on behind the scenes. A little overall knowledge on what equipment the vehicle has is helpful when you're trying to determine if a measured spike in current draw is a normal activity or the phantom battery drain you've been trying to catch. Unless you're using a scope on a long-time base or another piece of equipment such as a data recorder (**Figure 5**), always use your watch to check the time and jot down when a current spike occurs. If the same current spike occurs EXACTLY every 10 minutes (**Figure 6**), is only an amp or so and lasts a second or two, you probably

6

Time (Min)	Average Current (A)
0	-4.950
0.5	-1.290
1	-0.658
1.5	-0.450
2 – 9.5	-0.436
10	-0.102
10.5	-0.018
11	-0.018
11.5	-0.020
12	-0.020

MEASURING THE CURRENT DRAW OVER TIME on a 2012 Cadillac Escalade. When the battery cable is initially connected through an ammeter, the current draw is almost 5 amps as various modules that are active with the key off power up. Within 1 minute, we see most modules have gone to sleep but the drain is still excessive. After 10.5 minutes, the current draw falls to an acceptable -0.018 amps (18 mA).

PHOTO: (LEFT) MIDTRONICS (RIGHT): GENERAL MOTORS



THIS VEHICLE'S BATTERY DRAIN (AFTER 10 MINUTES) went down to just over 7 mA but popped up to 9.5 mA periodically. Every 2 seconds this vehicle security light blinks. Placing the meter next to the blinking LED showed the increased current draw occurs just slightly after the light blinked (meter update delay) allowing us to correlate a normal event via meter observation.

aren't looking at the reason for the customer's battery drain. In the 10-minute example, a likely normal occurrence would be a Telematics (OnStar, Lexus Link, etc.) module waking up temporarily to determine if any calls to the vehicle from a call center are coming in. Other normal parasitic loads occur every few seconds, such as a theft deterrent LED blinking (**Figure 7**).

Step 5. Isolate the sub circuit (without pulling fuses). OK – so you have caught phantom in the act. Let's say you

have 350 mA (0.350 amps) running the battery down. Time to determine out what circuit that drain is on and then identify what sub circuit/component is the root cause. Do you pull fuses? NO! That's old school. Pulling fuses only works if you pull the guilty fuse FIRST! Remember Murphy's Law of battling the phantom drain? Don't waste time battling module power down/power up/entering sleep mode over and over.

Step 5a. Voltage drop test each fuse. If the fuse's metal contacts are not accessible (plastic covers) you'll have to pull each fuse individually. If the drain doesn't go away, you'll then need to reinstall that fuse and wait several minutes if the battery drain shoots back up even higher while any modules on that fuse power back up and then gradually go back to sleep. On fuses where you can access their probe test points (as you do when checking them for being blown), you are not looking for excessive voltage drop. You are looking for ANY voltage drop. Any circuit with current flowing (even a tiny bit) will have "some" voltage drop. Take care to get a VERY good bite with your meter tips on each fuse's set of metal probe points. Use your meter's mV (millivolts) setting. When you've got a good contact on BOTH probes with the fuse, the meter will settle completely on a number. That number will either be 0.00 mV (no current flowing – **Figure 8**) or some very small mV reading that is rock solid and not changing. A constantly changing mV reading is not an accurate reading of anything — it's sim-

Fuse Voltage Drop Chart - Mini Fuse

Circuit Current Across Fuse (milliAmps)

Fuse Color	Grey	Violet	Pink	Tan	Brown	Red	Blue	Yellow	Clear	Green
Measurement mV	Mini 2 Amp	Mini 3 Amp	Mini 4 Amp	Mini 5 Amp	Mini 7.5 Amp	Mini 10 Amp	Mini 15 Amp	Mini 20 Amp	Mini 25 Amp	Mini 30 Amp
0.1	2	3	4	6	9	13	22	31	42	54
0.2	4	6	9	11	18	27	44	62	85	108
0.3	5	9	13	17	28	40	66	93	127	162
0.4	7	12	17	23	37	54	87	125	169	216
0.5	9	15	21	28	46	67	109	156	212	270
0.6	11	18	26	34	55	81	131	187	254	324
0.7	13	21	30	39	65	94	153	218	297	378
0.8	14	24	34	45	74	108	175	249	339	432
0.9	16	27	38	51	83	121	197	280	381	486
1	18	30	43	56	92	135	218	312	424	541
1.1	20	33	47	62	101	148	240	343	466	595
1.2	22	36	51	68	111	162	262	374	508	649
1.3	23	39	55	73	120	175	284	405	551	703
1.4	25	41	60	79	129	189	306	436	593	757
1.5	27	44	64	85	138	202	328	467	636	811
1.6	29	47	68	90	147	216	349	498	678	865
1.7	31	50	72	96	157	229	371	530	720	919
1.8	32	53	77	101	166	243	393	561	763	973
1.9	34	56	81	107	175	256	415	592	805	1027
2	36	59	85	113	184	270	437	623	847	1081

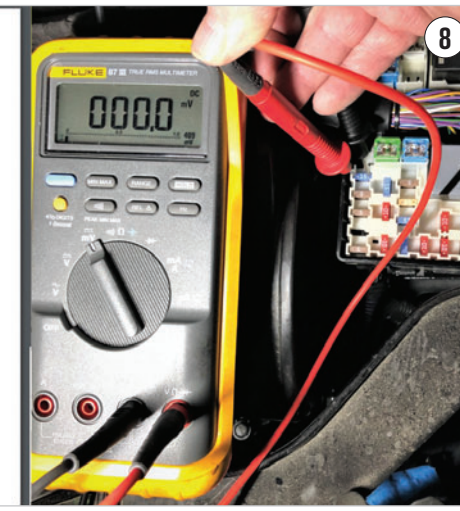


PHOTO: (CHART) POWER PROBE

POWER PROBE'S EASY-TO-USE CHART. 0.00 mV means zero current draw. On a 10-amp mini fuse, 2 mV of voltage drop on a fuse equals 270 mA of battery drain. More than enough to kill the battery in a few days! 0.2 mV would be fine though.

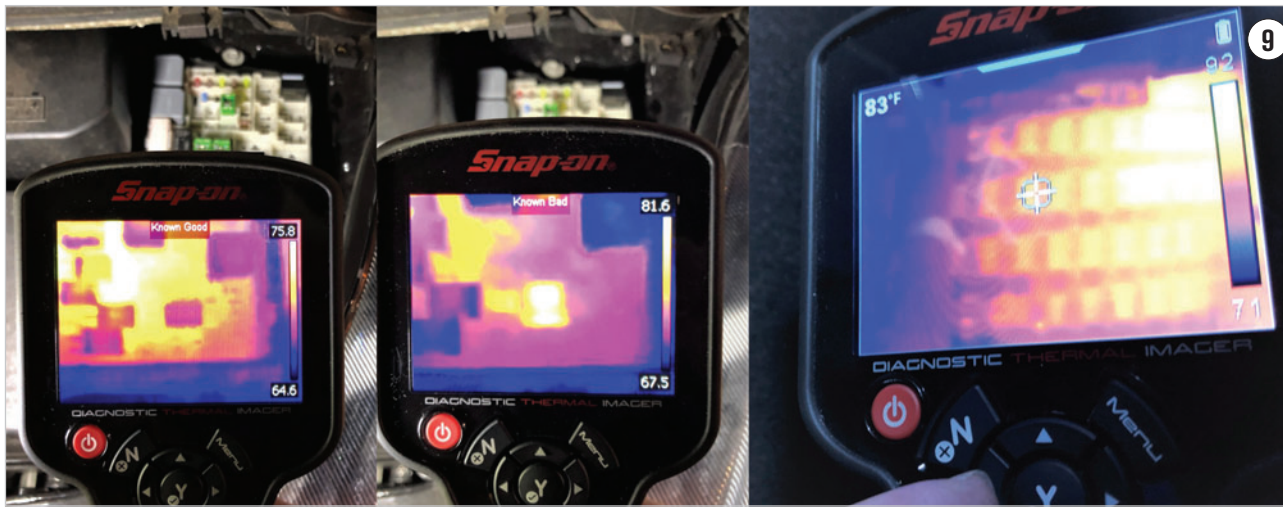


PHOTO: DAVE HOBBS AND RAY JOHNSON / CENTRAL LAKES COLLEGE

PHOTO ON FAR LEFT AND CENTER SHOW a Snap-On thermal imager's built-in library example of a known good image of a relay that has properly shut off compared to one that has stuck on. Photo at far right is a fuse panel after the vehicle has been shut off with no excessive parasitic current drain. Residual heat is shown across the entire fuse panel with the key off. There was no difference however, in temp images of the dome light fuse – lights on or off.

ply "digit rattle," which is the meter and leads catching stray EMI through the air. Take any mV readings you measure and refer to a mV to mA conversion chart. Power Probe has one of these charts on their website www.powerprobe.com/fuse-voltage-drop-charts. The chart allows you to factor the fuse's type and amp rating along with your measured mV voltage drop reading and determine exactly how much current that sub circuit is drawing (**Figure 8**).

5b. Use advanced tools. A DSO (Digital Storage Oscilloscope) cannot only be used to measure current draw over time (with an accurate enough low amp inductive amp clamp); it can also be employed to observe data bus activity. ANY activity on ANY data bus after 20-30 minute of ignition off (with any smart fobs OUTSIDE the vehicle) should be investigated. Going back to Step 5 (knowing what's normal) is a big help here. Did the HS CAN bus become active for a few minutes in order to perform an EVAP test? In that case the PCM will temporarily be awake but shouldn't run the battery down. Is there an intermittent faulty door jam switch waking up the BCM over and over making the LS CAN bus intermittently active? That will drain a battery. While the BCM is awake, plug in a scan tool and look for signs of improper door latch status if the OEM puts such a PID on the bus. Another advanced tool to employ in your hunt for the phantom drain is a thermal imager (**Figure 9**). It will show relays stuck on (big battery drains) and even a power feed circuit with insulation chaffed creating a high resistance short to ground.

Words of wisdom

My personal mentor in phantom hunting (my dad Ray Hobbs) always said the most advanced tool you can employ to unmask the phantom drain is your experience and ability to reason. Remember pulling all DTCs in all modules back in Step 1? Any module that continues to be involved in the setting U-codes even after the battery has been recharged/replaced is worthy of your scrutiny. A module that should normally be asleep with the ignition off (i.e. ABS) and continues to be implicated with U-codes may indeed be the phantom itself. Happy phantom hunting!

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

WINNING THE BATTLE AGAINST AXLE NOISE AND VIBRATION

STEPS TO TACKLE ISSUES OFTEN DEEMED DIFFICULT TO DIAGNOSE AND REPAIR

JOHN D. KELLY // Contributing Editor

There are more than 8 million trucks and SUVs produced each year in North America. If 50 percent of those vehicles are four-wheel drive or all-wheel drive, a total of 12 million axle assemblies are needed to supply those vehicles. Twelve million axles per year equal 32,876 per day, or 1,370 per hour, or 22.83 axles per minute. What are the chances that every axle is set up correctly? The chances are pretty low. I tell my students, "Just because it is new, does not mean it is set up correctly."

Over the years, I have received many questions related to what has become known as "Chevy Shake" vibrations on later-model Chevrolet, GMC and Cadillac trucks and SUVs. Similar vibrations have occurred on the Ford Mustang, the Ford F-150 and Ram 1500 and 2500 trucks. The frustrating thing for the customer is that nobody can diagnose and repair them, or, even worse, they are told it is normal.

MEASURING TOTAL TURNING PRELOAD ON A REAR AXLE

A tale of two trucks

I have been personally involved in diagnosing two vehicles that were purchased back from the customers for unresolved vibration problems. The first vehicle is a $90k 2015 Cadillac Escalade 4x4 SUV. The second is a $55k 2014 GMC Denali 1500 Series 4x4 Crew Cab short-bed pickup truck. Both of these vehicles had the exact same cause of the vibration: a rear axle that was not set up correctly.

2015 Cadillac Escalade 4x4 SUV

In the spring of 2016, I was teaching a manual drivetrain class at the university where I work. As part of that class, we always go through the complete inspection, disassembly, repair and assembly process of a rear axle. We had three vehicles on the hoists and five axles on the workbenches. I love to work on vehicles with real problems, so I gathered my students around the 2015 Cadillac Escalade 4X4 on the hoist and told them about the vibration problem that resulted in the buyback of this vehicle. I told them we would carefully inspect the 9.75" rear axle as we disassembled it to see if the rear axle

PHOTOS: JOHN D. KELLY

INTRODUCING
FVP BRAKE PADS

FRICTION ENGINEERED FOR THE PROFESSIONAL.

PFT™ PROFESSIONAL FRICTION TECHNOLOGY

FVP Brake Pads are designed and tested to meet OE standards.

THE TRUSTED BRAND WHEN YOUR REPUTATION IS ON THE LINE.

Designed with Professional Friction Technology (PFT) and application-specific composition, FVP Brake Pads meet the high standards of today's professional technicians. For OE quality, performance and even wear, trust FVP.

Visit FVPparts.com

MANUFACTURED IN NORTH AMERICA

2025 ZERO COPPER STANDARD

100% POST CURED

HARDWARE INCLUDED

FMP FACTORYMOTORPARTS™

WE SUPPLY YOUR SUCCESS.®

had any troubles that may have contributed to the vibration.

Following the same diagnostic procedure I have taught for years, one of the very first steps you should perform when diagnosing and disassembling a rear axle is to measure what is known as the "Total Turning Preload" of all the preloaded bearings that hold the ring and pinion gearset in place inside the axle housing. This measurement should be done at the pinion nut with the driveshaft, wheels, tires and brake rotors removed. Using a flexible beam-type or dial-type inch-pound torque wrench, a technician should rotate the pinion nut and see what the constant rotational torque (effort) is. Typically, the measurement is at least 1.7 - 2.8 Nm (15 - 25 in*lbf) on an axle that is set up correctly, and we measured zero! I could not believe it! The only time I had ever read anything close to 0 Nm (0 in*lbf) of rotational torque was on a 35-year-old severely worn axle with high mileage on it. This axle is in a one-year-old Cadillac; how could this be?

2014 GMC Denali 1500 Series 4x4 Crew Cab short-bed pickup truck

Next, we moved to the 2014 GMC Denali 1500 Series 4X4 Crew Cab short-bed pickup truck and performed the same measurements. It also read 0 Nm (0 in*lbf) of rotational torque for the "Total Turning Preload" measurement. The truck had the same rear axle housing, except it had a 9.5" ring gear rather than the 9.75" ring gear in the Cadillac. Having two vehicles with zero bearing preload is unheard of; there must have been a problem with the axle setup, the lubricant,or something was very wrong here from the factory. My suspicions in 2016 were confirmed earlier this year (2019) when a friend of mine, who is also a GM Field Service Engineer, confirmed that "many of the axles out of an assembly plant in Mexico had problems."

There is no excuse to have an improper setup axle on a new vehicle anymore. Axles have been mass produced for more than 100 years now. Sure, there have been improvements in materials and machining, but the same setup process has been in use all of that time. A properly set up axle is silent under all operating conditions and temperatures; it outlasts the lifespan of the rest of the vehicle.

Causes of axle vibrations and noises

Improper Bearing Preloading — Proper bearing preload on the ring and pinion gear set prevents the gears from moving vertically, horizontally or diagonally as they rotate. Improper bearing preloading allows the gears to push away from each other as you accelerate your vehicle and pull together as your vehicle decelerates. Any gear movement can cause the gear backlash to become too small and have the gears bind with each other as they try to rotate. These conditions cause noises, vibrations and oil leaks.

- The ring gear rotates at tire speed and can mimic a tire speed-related vibration.

THE 2015 CADILLAC ESCALADE with an "unfixable" vibration

DIFFERENTIAL CASE side bearing preload.

AN EXAMPLE gear tooth contact pattern.

3C Intelligent Induction Cleaner™

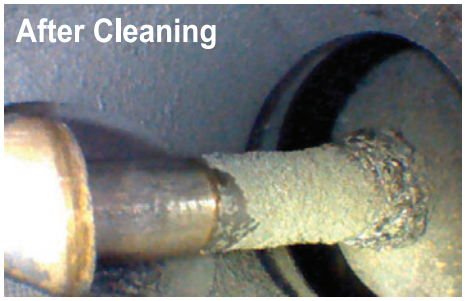
Patent Pending

Heavy Carbon GUARANTEED Deposits Removed

The tune-up for the modern GDI engine

Works on gasoline based engines

1.6L Turbo Mini Cooper at 83,000 miles (cleaned in just 14 minutes)



All of our chemistries have a low HMIS health rating of 2. None of our chemicals are on the California Proposition 65 list.

ATS | AUTOMOTIVE Test Solutions

Proud to be a U.S. based company

automotivetestsolutions.com

800.572.6112

Available at AE TOOLS & COMPUTERS · NAPA AUTO PARTS · WORLDPAC Wholesale Distributor of Original Equipment Automotive Parts · Advance Auto Parts

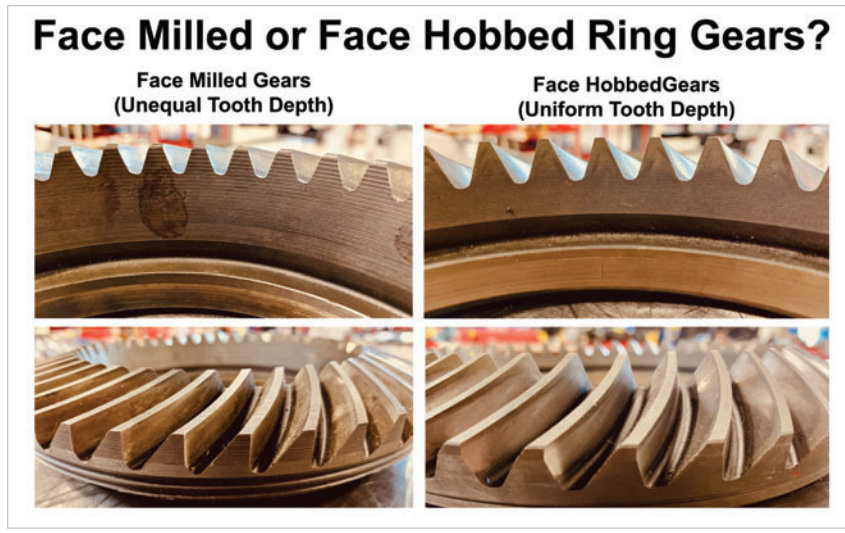
- The pinion gear rotates at driveshaft speed and can mimic a driveshaft speed-related vibration.
- Improper pinion bearing preload can cause what appears to be a pinion seal leak, but the seal is fine, the pinion gear is moving vertically, horizontally or diagonally as it rotates. No seal can hold on oil under those conditions.

Improper Gear Tooth Contact Pattern — A properly set up axle utilizes the entire length of each gear tooth to transfer all the torque from the engine/transmission to the axles/wheels. A gear tooth contact pattern check will reveal if the proper contact is being made. If improper tooth contact is made, only part of the gear tooth is transferring all the torque from the engine to the wheels. This can cause noises, uneven tooth loads and contribute to broken gear teeth and catastrophic axle failure. Improper bearing preloads can contribute to these conditions.

- An axle noise that only occurs on acceleration is an indication of improper gear tooth contact on the drive side of the ring gear teeth.
- An axle noise that only occurs on deceleration is an indication of improper gear tooth contact on the coast side of the ring gear teeth.
- An axle noise that occurs on acceleration and deceleration is an indication of improper gear tooth contact on both the drive and coast sides of the ring gear teeth.

Diagnostic disassembly steps

Do you want to be able to quickly diagnose axle problems as we did with the two trucks listed above? You should never start unbolting parts and disassembling an axle with noises or vibrations. There are many clues you can find by carefully taking measurements and making observations during disassembly. I have my students use the following steps during axle disassembly in my classes.



EXAMPLES OF FACE-MILLED and face-hobbed ring gears.

1. Measure the Total Turning Preload (TTP) — This measurement should be done at the pinion nut with the driveshaft, wheels, tires and brake rotors removed. Using a flexible beam type or dial-type inch-pound torque wrench, rotate the pinion gear at the pinion nut to measure the Constant Rotational Torque (CRT) of the pinion bearings and the differential case side bearings combined. *Note: Some axles use the "Break Away Torque (BAT)" rather than the CRT. Typically, the CRT measurement is at least 1.7 - 2.8 Nm (15 - 25 in*lbf) on an axle that is set up correctly. Anything less is an indication of a problem.* **IMPORTANT: while rotating the pinion gear at the pinion nut, watch and feel for any fluctuations in the rotating effort. Any fluctuations can indicate damaged bearings.**

2. Inspect the oil/fluid — Utilizing a drain pan to capture and save the fluid, remove the differential cover and inspect the oil for a burnt odor, for contamination from water/rust/corrosion, for metal flakes (many differential covers have a magnet to attract loose metal flakes). Any problems with the oil/fluid can indicate the need for a complete overhaul of the axle assembly.

3. Ring gear type – Look at the ring gear to determine if it is a face-milled ring gear (with unequal gear tooth depth), or face-hobbed ring gear (with uniform gear tooth depth). Face-milled ring gears are more prone to suffer from backlash variation problems. These two ring gear types also have different gear tooth contact patterns.

4. **Measure the backlash variation** — If the TTP from step one was within specification, measure and record the backlash of every gear tooth on the ring gear, (yes, all 32-48 gear teeth). Any difference between the lowest backlash measurement and the highest backlash measurement greater than 0.051mm (0.002") indicates a problem. The problem could be with the ring gear itself, or with the differential case to which it is bolted. Further measurements of differential case lateral and radial runout are necessary. Any differential case runout higher than 0.051mm (0.002") indicates the differential case must be replaced.

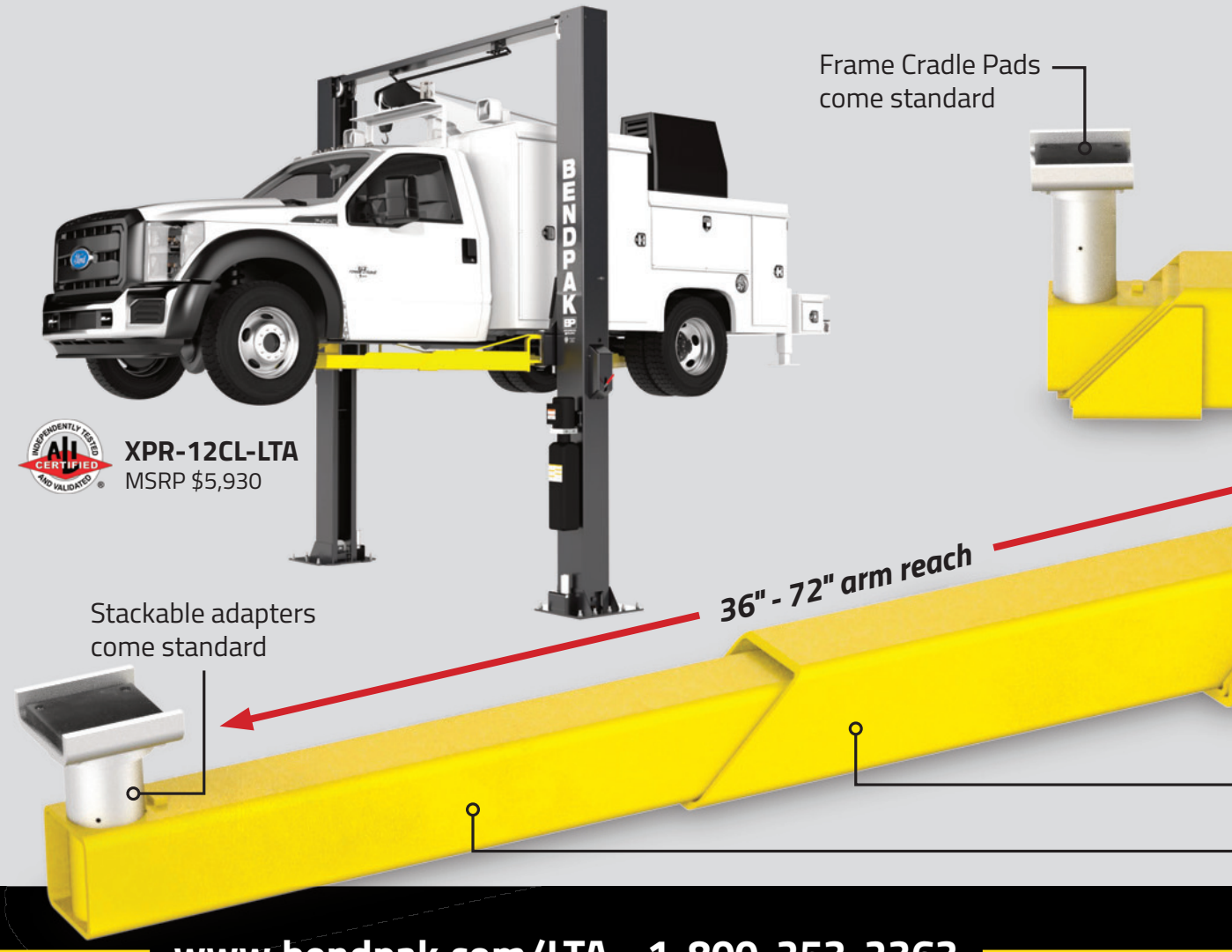
5. Measure the Pinion Bearing Preload (PBP) — Important: Mark all parts as left side or right side when removing them. Remove the axle shafts, differential case bearing caps, and the differential case. The dif-

WHEN BALANCING SAFETY AN

BENDPAK GOES THE

LONG-REACH ARMS PROVIDE BETTER CENTER-OF-GRAVITY LOADING

When servicing trucks and vans with extremely long wheelbases, longer-reach arms deliver a more stable lifting solution. The lengthy triple-telescoping arms on BendPak's new **ALI Certified XPR-12CL-LTA** extend to 72" long – that's six feet in length and over one foot longer than almost any other lift or brand in its class. And with rugged BendPak dependability combined with a 16-piece adapter set, you'll realize that balancing safety* and worker productivity has never been so perfectly matched. For more information visit **www.bendpak.com/LTA** or call **1-800-253-2363**.

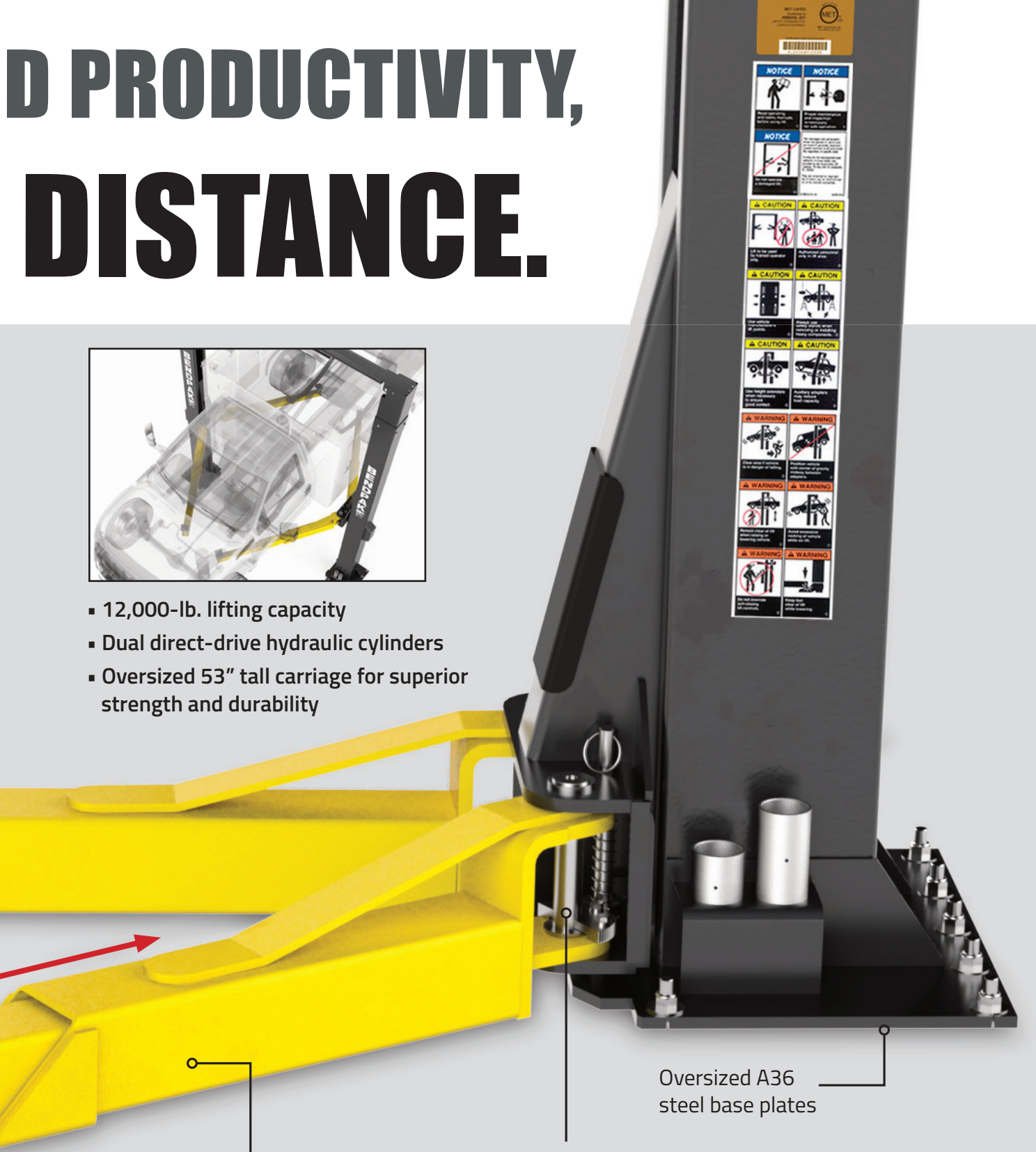


www.bendpak.com/LTA ▪ 1-800-253-2363

D PRODUCTIVITY,

DISTANCE.

- 12,000-lb. lifting capacity
- Dual direct-drive hydraulic cylinders
- Oversized 53" tall carriage for superior strength and durability



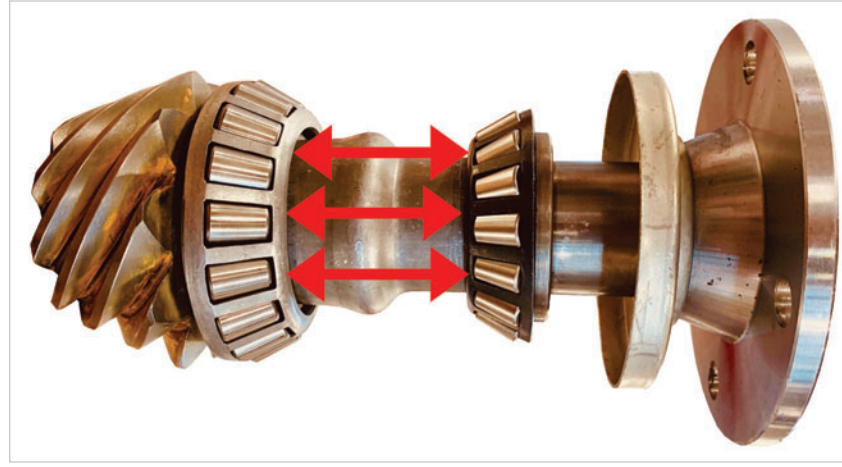
*Always read and follow all safety warnings that accompanied your lifting equipment at the time of purchase. More information regarding vehicle lift safety is available directly from BendPak or from the Automotive Lift Institute.

AUTOMOTIVE LIFT INSTITUTE ALI MEMBER ®

BP BendPak®

ferential case should be difficult to remove if it has the proper amount of side bearing preload. You may have to pry on the ring gear bolts to remove the differential case from the differential housing. Using an inch-pound torque wrench, rotate the pinion gear to measure the CRT of the pinion bearings alone. Typically, the CRT measurement is at least 1.1 - 1.7 Nm (10 - 15 in*lbf) on an axle that is set up correctly. Anything less is an indication of a problem.

After making all the measurements and inspections listed above, you will have a good idea of the parts required and how much work is needed to repair the axle. Always replace the bearings when the bearing preload is out of specifications. *Note: Replacement bearings can be thicker or thinner than the original bearings. Because of this, it is very rare that the thickness of the original pinion depth shim(s) and differential case side bearing shims will be correct to use with the new bearings.*



PROPER PINION BEARING PRELOAD holds the pinion gear from moving while rotating

NON-REUSABLE CAST IRON SHIM (left) and a service spacer and shim (right).

Critical reassembly steps

Almost anyone in a wrinkly T-shirt can bolt the axle parts together and send the vehicle down the road; it takes a trained technician with a lot of patience and attention to detail to set up an axle correctly. Proper setup of an axle can take four to eight hours depending upon how lucky you might be.

Before reassembling an axle, clean everything thoroughly. Always use the correct thread locking compound and primer before installing bolts or nuts. Only use the correct axle gear lubricant during reassembly to lubricate bearings and gears. Use the following steps to assemble properly and set up an axle.

1. Avoid bearing brinelling — When assembling an axle assembly, do not hit bearings or parts with bearings on them with a hammer or impact wrench; bearing brinelling (small indentations in the bearing surfaces) can occur. Bearing brinelling causes fluctuations in the rotating effort of the bearing. Any fluctuations can indicate damaged bearings.

2. Set pinion depth — If you have access to the special tools needed to measure the shim(s) required for the pinion depth, use them. If you do not have access to the tools, use the old pinion depth shim(s), but be mentally prepared to disassemble the entire axle again to change the depth shim if the gear tooth contact indicates the shim thickness is incorrect. Changing the pinion depth shim typically requires replacing the pinion seal, front pinion bearing, and the crush sleeve (if equipped).

3. Set pinion bearing preload — Set the pinion bearing preload at the high end of the specifications. Over time the bearing preload will only loosen, so if you start at the high end of the specifications, it will last longer. There are two methods of setting bearing preload.

- Method one uses a crush sleeve and a non-reusable pinion nut. Tighten the nut until the proper PBP is obtained. If the PBP is incorrect, change the crush sleeve, front bearing, seal and nut and measure the PBP again.
- Method two uses pinion preload shims and a non-reusable pinion nut. Tighten the pinion nut to a specific torque and then check the PBP. If the PBP is incorrect, change the preload shims, front bearing, seal and nut and measure the PBP again.

4. Set the differential side bearing preload — Set the differential side bearing preload at the high end of the specifications. Side bearing preload cannot be directly measured; it can only be calculated. The formula: ((TTP) – (PBP)) x Axle Gear Ratio = Side Bearing Preload. Example: ((30 in*lbf) – (20 in*lbf)) x 3.23 = 32.3 in*lbf. If the side bearing preload is incorrect, change the side bearing shims by an equal amount on the left and the right sides to prevent changes in the ring gear backlash. Some axles use threaded side bearing adjusters rather than shims to set bearing preload and backlash.

5. Set the ring gear backlash — Set the ring gear backlash at the middle of

the specifications. If the backlash is incorrect, adjust the side bearing shims by decreasing the shim thickness on one side by the same amount of the shim thickness increase on the other side. This will maintain the side bearing preload.

6. Run a contact pattern check — Using gear marking compound, paint the drive and coast side of every ring gear tooth, not just three or four teeth. Install the axle shafts and brakes. Partially apply the brakes to load the ring gear to the point that it takes about 50 ft*lbf to rotate the pinion flange. Rotate the flange 3 to 4 rotations forward and backward.

7. Interpret the contact pattern — Make all final adjustments to the axle set up based upon the gear tooth contact pattern results. Always recheck the pattern after adjustments are made. There are five possible patterns if the backlash is within specifications:

- **Centered** — The pattern is centered along with the gear teeth on both the coast sides (concave) and drive sides (convex) of the ring gear teeth.
- **Toe-Heel** — The contact pattern is closer to the toe of the drive side and the heel of the coast side of the ring gear teeth. Move the pinion gear away from the ring gear.
- **Heel-Toe** — The contact pattern is closer to the heel of the drive side and the toe of the coast side of the ring gear teeth. Move the pinion gear closer to the ring gear.
- **Toe-Toe** — The contact pattern is closer to the inside of the ring gear teeth (the toe) of both the drive and coast sides of the ring gear teeth. The backlash is too small.
- **Heel-Heel** — The contact pattern is closer to the outside of the ring gear teeth (the heel) of both the drive and coast sides of the ring gear teeth. The backlash is too wide.

A CONTACT PATTERN INTERPRETATION CHART for face-hobbed gears.

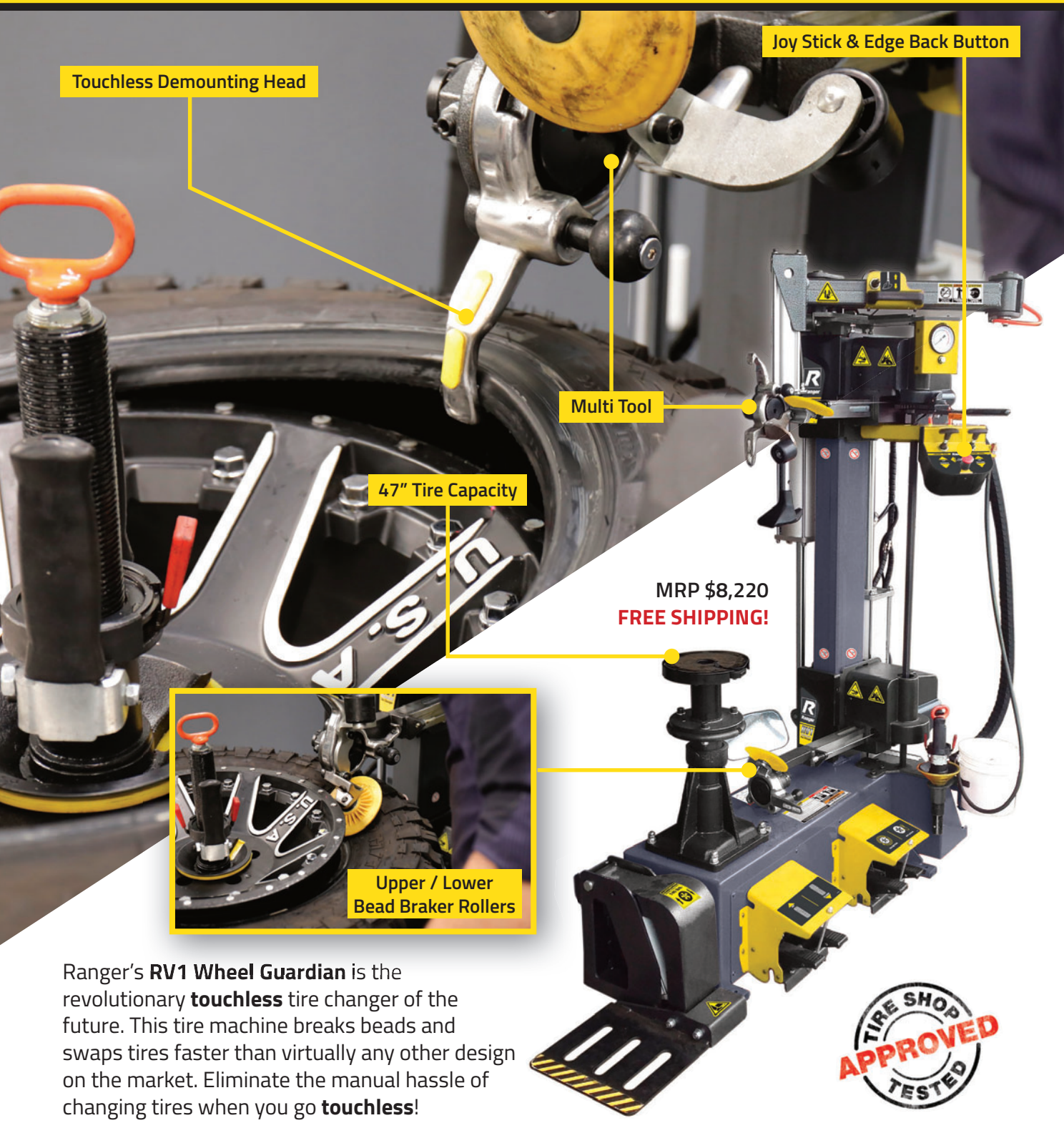
Summary

With the two trucks at the start of this article, we replaced all the bearings and one ring and pinion gear set and set up the axles correctly upon reassembly. We could not drive the vehicle on the road since they were donation vehicles to my school, but we did test them on the hoists — the vibrations were gone.

There were incorrectly set-up/failing parts in these axles, but nobody (including several competent flat-rate technicians and a GM "Field Service Engineer"), detected them. Two unhappy customers were the result. Thousands of dollars were wasted on attempted repairs; many hours of labor were wasted. My students and I diagnosed both of these vehicles in less than 30 minutes by following basic diagnostic steps; you can do the same thing. Best wishes!

JOHN D. KELLY is a professor of automotive technology at Weber State University in Ogden, Utah, and a former technician. He specializes in automatic and manual drivetrain and NVH diagnosis and hybrid and electric vehicle technology.
Jkelly1@weber.edu

CHANGE THE WAY YOU CHANGE TIRES



MRP $8,220
FREE SHIPPING!

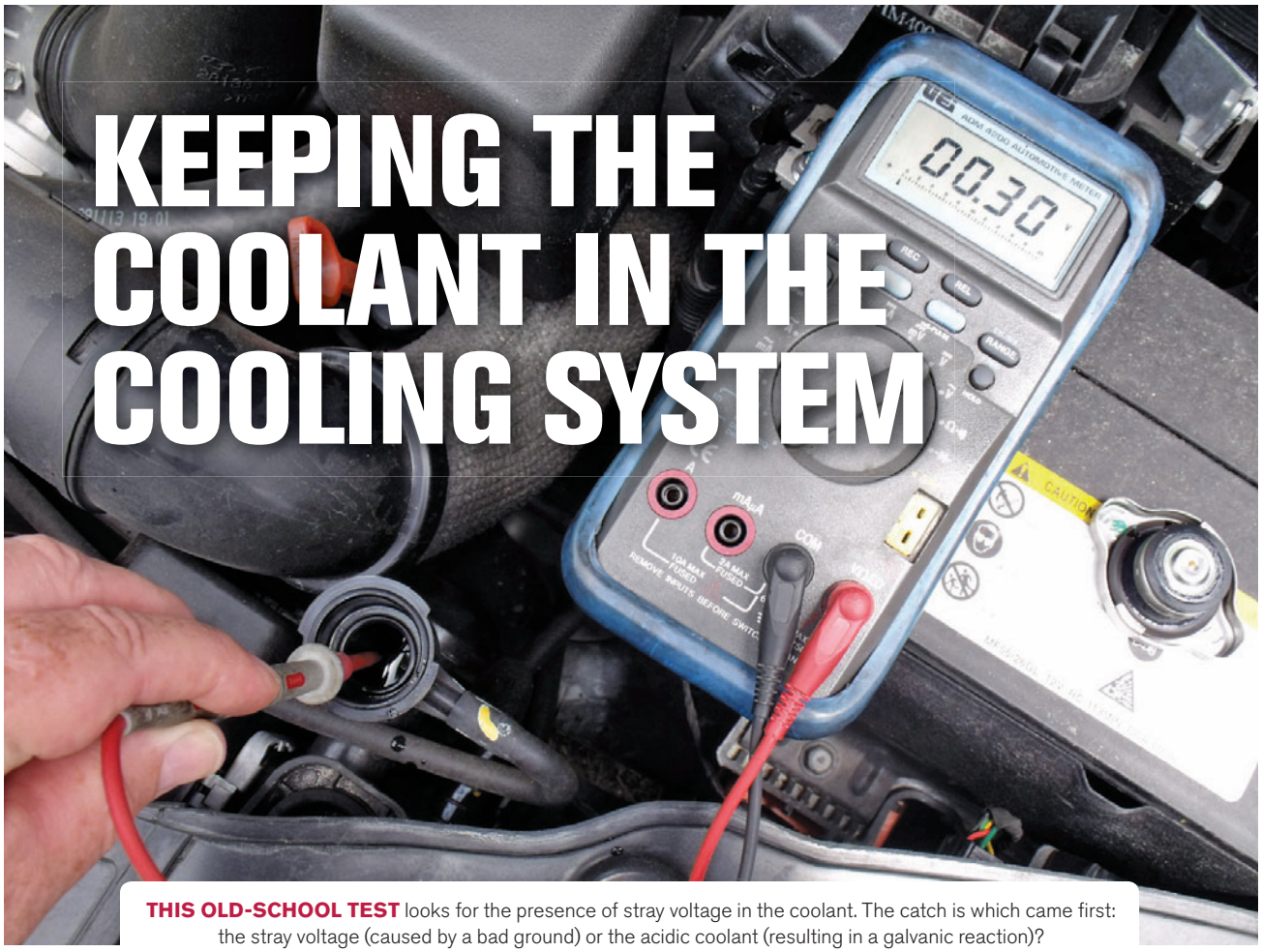
Ranger's **RV1 Wheel Guardian** is the revolutionary **touchless** tire changer of the future. This tire machine breaks beads and swaps tires faster than virtually any other design on the market. Eliminate the manual hassle of changing tires when you go **touchless**!

1-800-253-2363 ▪ bendpak.com/touchless

*Free shipping to direct shipping points within the 48 contiguous United States only.

Ranger®

KEEPING THE COOLANT IN THE COOLING SYSTEM



THIS OLD-SCHOOL TEST looks for the presence of stray voltage in the coolant. The catch is which came first: the stray voltage (caused by a bad ground) or the acidic coolant (resulting in a galvanic reaction)?

AS THE WEATHER TURNS COLD, OUR ATTENTION TURNS TO THE NEEDS OF THE COOLING SYSTEM. IS IT READY TO WEATHER WINTER?

PETE MEIER // Contributing Editor

Even though the cooling system has a year-round job to do, it seems that we pay a little more attention to it when the leaves start to turn color and the temperature starts to drop — not that that has anything to do with the cooling system's role in dispersing excess heat generated by the engine. No, as the mercury starts to drop, our concern is whether or not the coolant is protected from freezing in the block — and that's not a bad starting point for any cooling system inspection!

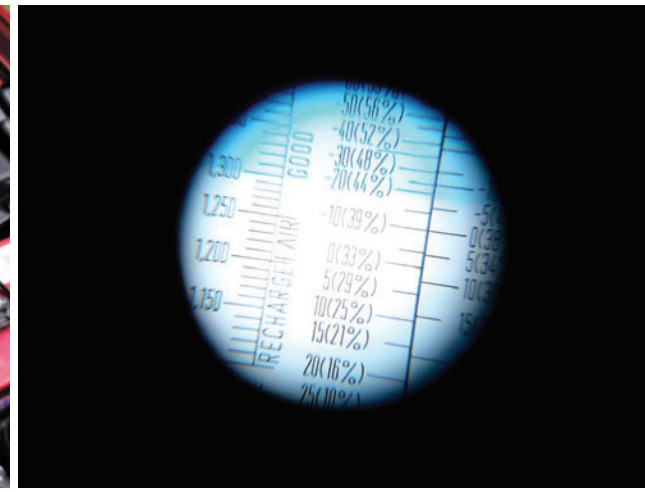
It's a package deal

The coolant used to protect your customers' engines is similar in all applications in that it is typically a 50/50 mix of water and ethylene (or propylene) glycol.

Why a mix? Water is an excellent medium for removing heat, but it provides no protection to the buildup of rust or corrosion in the cooling system passageways or components. It also has a limited operating range, with a freeze point of 32°F and boiling point of 212°F. The development of pressurized cooling systems back during World War II helped raise the upper limit a bit, but it did nothing to lower the bottom end, so something had to be added to the water to prevent freeze up. Hence, the glycol.

Ethylene glycol has a freeze point of 10°F and a boiling point of 386°F. The high end is plenty good, but the low end is still short on freeze protection when used in extremely cold climates. Alone, it is also less efficient than water at absorbing heat — about 10 percent to 20 percent less efficient. So, while it appears a better choice than pure water alone (and it is), the use of coolant alone is still lacking and no better as an option.

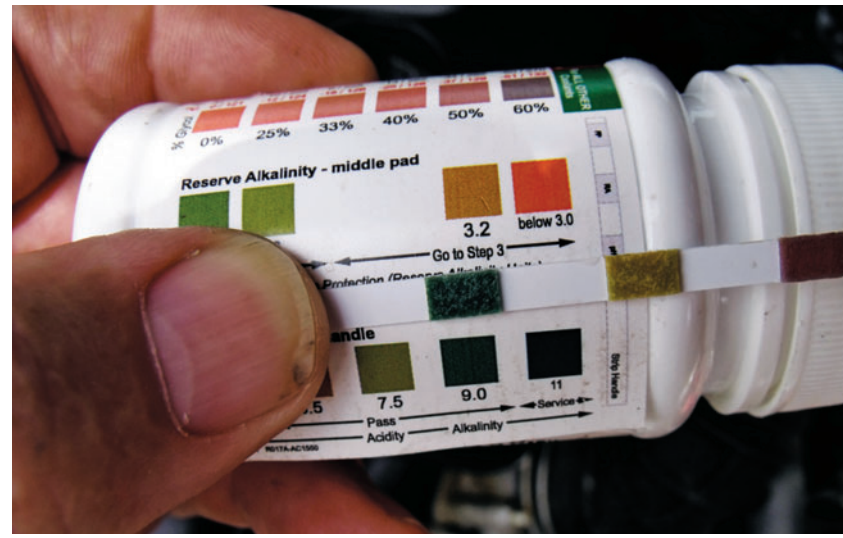
PHOTOS: PETE MEIER



THE BEST WAY TO CHECK THE MIXTURE RATIO is with a tool called a refractometer. Just be sure to compensate as outlined in the tool's manual prior to taking your reading.

However, when mixed in a 50/50 proportion, the resulting cooling fluid has a freeze point of -34°F and, with a 14 psi radiator cap installed, a boiling point of 265°F. According to most of the manufacturers I spoke with, a working mixture range of 40 percent to 60 percent will still provide sufficient heat transfer while maintaining freeze protection.

What's the best way to test the mixture ratio? Manufacturers agree that the use of a refractometer is the best way to test, with coolant test strips coming in a close second. They also agree that the hydrometers of old are not accurate enough to test the coolant mixture and should be avoided.



TEST STRIPS ARE FAST AND ACCURATE WAYS to test coolant. Both mixture ratio and the essential pH check can be done in minutes.

Still serviceable

If the mix ratio is OK, does that mean the coolant is still serviceable?

We still haven't done anything to protect the cooling system internals from the effects of the water passing through them. An additional chemical package is added to the cooling fluid to protect components and passages from the effects of oxidation and corrosion. This package is called the "inhibitor package" and is generally designed to keep the coolant mixture a tad on the alkaline side, rather than the acidic side. There are three basic types of coolant mixtures: Inorganic Acid Technology (IAT), Organic Acid Technology (OAT) and Hybrid Organic Acid Technology (HOAT). OEMs may require tweaks on the inhibitors for their own models and that's one reason there are so many different combinations and colors on the market.

Now, I don't care if you know an IAT from an OAT or an HOAT. What I do care about is that you understand that these inhibitor packages don't last forever. As they "drop out" or are used up, the coolant becomes more acidic. This leads to leaks in the heat exchangers, damage to the water pump impeller and erosion of the passageways to the point of internal coolant loss.

What causes the inhibitor package to be consumed? Aging of the coolant is one and that's the reason for the service interval you see in the maintenance schedule. But other factors can speed up the process and if left unchecked or undiagnosed, allow cooling system damage to begin long before that interval arrives. For example, contamination

PicoScope®

4 8 2 3

More channels.
More potential.

8-channel diagnostic oscilloscope

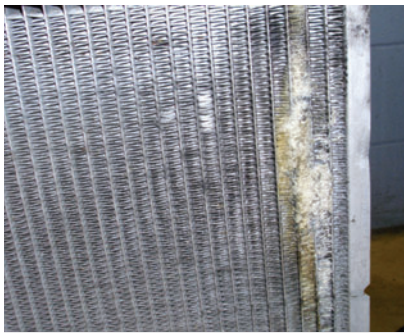
- Take multiple measurements simultaneously
- Fast enough for CAN, CAN FD and FlexRay
- Access to 150 guided tests and the waveform library

Find out more at:
www.picoauto.com/A427

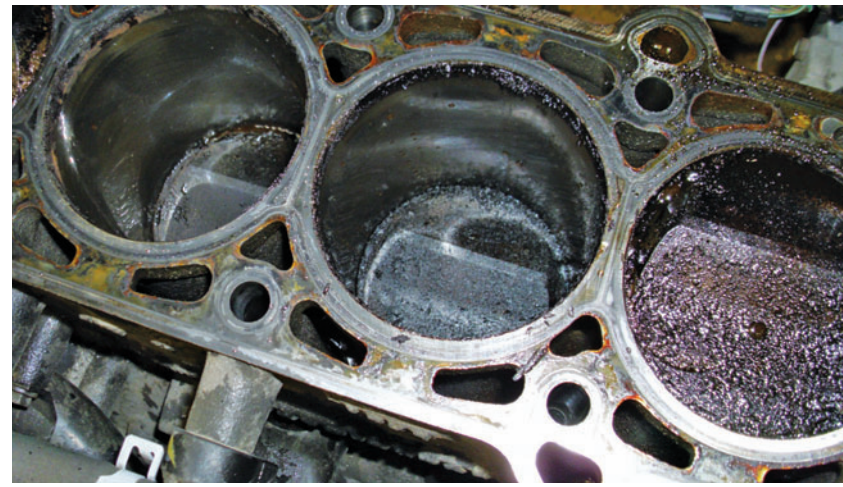
Email: sales@picoauto.com. Errors and omissions excepted.
Please contact Pico Technology for the latest prices before ordering.

YouTube

Visit our YouTube channel to watch guided test videos and more!
Search for **PicoScope Automotive**



THIS LEAK IS THE RESULT OF POOR maintenance. The coolant inhibitors were used up and corrosion began to set in, eventually eating through the radiator's tubing.



LEAKING HEAD GASKETS are common as well, with some resources estimating that 50 percent of the cars on the road suffer from at least a minor one. And that's all it takes to impact the longevity of the coolant.

of the coolant (by internal fluid leaks or combustion chamber gasses mixing with the coolant) is more common than you think. One resource I spoke with estimates that nearly half of the vehicles on the road today have leaking head gaskets that can shorten the life of the coolant, yet not pose any drivability issues for the consumer other than having to top off the recovery bottle every now and then.

Another common cause of premature loss of the inhibitors is a bad engine-to-chassis electrical ground. Bad ground(s) can encourage current to find its way back to the battery through the cooling fluid and that results in a rapid consumption of the inhibitors.

How do you test the condition of the inhibitor package? Coolant test strips typically include a section that will react to the pH level of the coolant. This is probably the easiest and most accurate way to test outside of having a lab analyze a sample.

Many of you may remember using a voltmeter to measure for the presence of stray voltage in the coolant. The process is simple enough. Attach the ground lead of your meter to the negative battery post and then insert the positive meter probe into the coolant, avoiding contact with the metal in the radiator. If the inhibitor package has been depleted and the cooling fluid has become acidic, the fluid will react with the metals in the cooling system similar to the way sulfuric acid reacts with the lead plates in the battery. It is called a "galvanic" reaction and produces a voltage potential you'll see on your meter face. Anything more than 0.30 to 0.50 volts is indicative of a problem.

A word of caution here, though. The presence of voltage on your meter does not necessarily provide conclusive evidence that it's the acidity level of the coolant that's causing the problem. You may be measuring the effects of that bad ground I mentioned earlier.

Both are bad news, and both need to be isolated and corrected. The question you have to answer, through testing, is did the acidity level of the coolant become excessive on its own or is there a bad electrical ground allowing the inhibitor killing current in?

Your inspection process

The first step I want you to take is to review the cooling system description for the vehicle you are servicing in your service information system. Many vehicles today use multiple coolant paths — heck, even multiple water pumps and thermostats!

Next, perform a thorough visual inspection. How much coolant is in the recovery bottle? Coolant doesn't just evaporate — if the level is low, there's a reason for it. Be sure to ask your customer, too, if they have had to add coolant with any regularity.

If there is any reason to suspect a leak, look for any visual signs of that next. These can be tough to see, especially if the leak is small. Pay special attention to the area where the plastic side tanks are attached to the radiator's heat exchanger. There is a gasket in there that allows for the thermal cycling of the components and that ages over time. The crimps holding the parts together can only be made so tight and small leaks here are common.

Dye technology has come a long way, and the addition of the proper dose of dye may make that leak a lot easier to locate. Just remember a few best practices. Use the dye maker's specified dosage in the system — no more and no less. Use the UV light that came with the dye kit. It makes a difference, as dyes fluoresce differently under different UV wavelengths. And use the yellow glasses to make the dye even more visible. It won't hurt to darken your work area a bit, either.

Don't forget to inspect the belts and

Made in Germany.
Made for you.

LIQUI MOLY

I use it!

"LIQUI MOLY makes specific oils for Asian vehicles like mine."

Ruben Corona
Corona Autowerks
Huntington Beach, CA

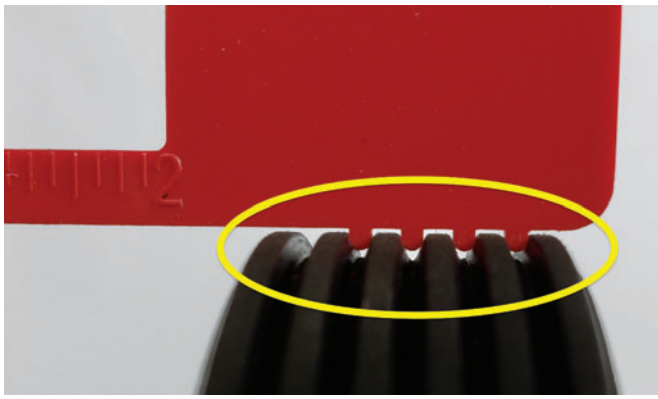
TRUE STORIES
TRUE BENEFITS. TRUE PASSION.

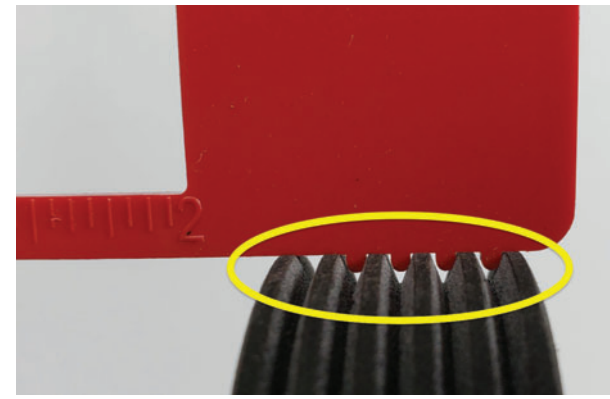
See the whole success story:

www.iuseit.us

#iuseit

For further information or technical support please call 1-888-MOLYOIL (665-9645)





THE ONLY WAY TO TEST ACCURATELY for serpentine belt wear is with a special gauge, available from nearly every company that makes these belts. The left image shows a good belt, the right a bad one.

hoses while you're at it. Since nearly every accessory drive belt today is a serpentine design made with EPDM and can be worn out well before you see any visual indications, you'll need a belt wear gauge to perform this check. As for the hoses, the biggest cause of cooling system hose wear is electrochemical degradation, or ECD, and it's not easy to detect. ECD attacks the rubber from within and is caused by the same acidity developed in the coolant we just talked about.

Check the hoses by squeezing them between your thumb and forefinger. The hoses should feel soft and pliable. If they feel tight or crunchy, they may require replacement. Take a close look at the hose connections, looking for signs of softness, bulging (especially when the system is under pressure), or cracks that could be signs of damage caused by ECD or age. Even if the hose appears to be OK, a good rule of thumb is to recommend hose replacement when a hose is over five years old.

Pressure test the system to make sure it can hold the pressure it's supposed to, and don't forget the cap. Weak caps resulting in lower boiling points can allow the water in the coolant to vaporize, creating air in the system. It can also prevent the normal siphoning of the coolant from radiator to recovery bottle and back again.

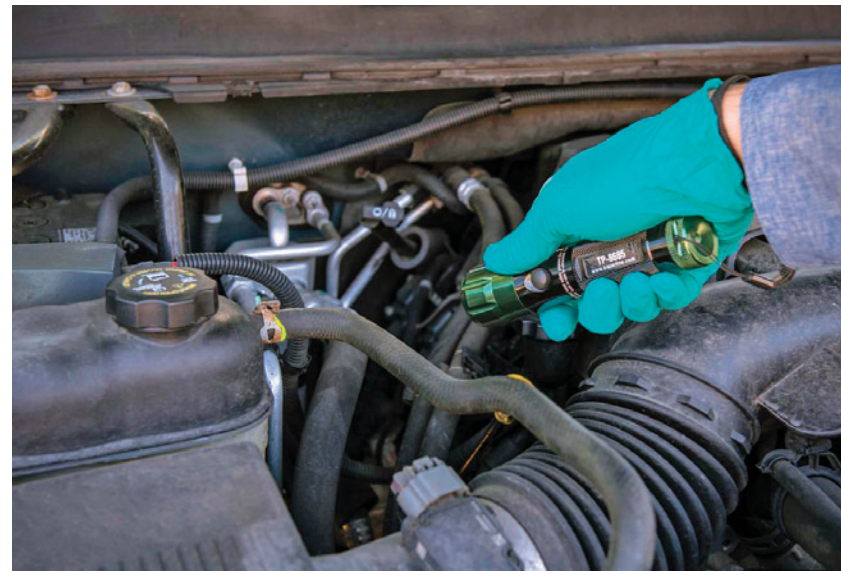


PHOTO: TRACER PRODUCTS

DYE HAS LONG BEEN USED TO FIND SMALL A/C LEAKS. Today, it can be effectively used to locate any fluid leak. Just follow best practices for best results.

Of course, using your refractometer and/or test strip, test the percentage mixture and pH level. If the pH level is OK, the percentage mixture can be adjusted by adding pure coolant or deionized water as needed, but if the pH is out of whack, only a thorough flush and refill will do the trick.

A word on water

You may have noticed that there are more and more pre-mixed coolants on the store shelves than there used to be. The reason is simple enough. Water is half the equation, and cooling systems are not very tolerant of water that is contaminated before it is even poured into the radiator.

I encourage you to use these premixed solutions to avoid complications caused by bad water. Even the best tap water is aerated to improve the taste, and using aerated water is a bad enough idea all by itself. Why would you want to add air to the cooling system right off of the bat?

Not too long ago, I got my hands on a testing tool called a "precipitator." This device passes an electrical current through the water sample and causes any solids in suspension to drop out and become visible. The results were

eye opening! If you must make up your own mixture, use deionized water (first choice) or distilled water (second choice) to not only fill the system, but also to flush the system to avoid leaving contaminants behind.

What about universal coolants?

According to an article on the Automotive Aftermarket Suppliers Association (AASA) website, "Universal coolants typically use a proprietary OAT formula that may or may not contain silicates (to meet the GM requirements), and no phosphates or borates (to meet European and Japanese requirements). Universal coolants can be mixed with ANY type of coolant, including the older traditional green formula coolants, and can be used to refill almost ANY year/make or model of passenger car or light truck. We say almost any application, because some experts say a traditional green formula coolant still provides the best corrosion protection for older vehicles with copper/brass radiators."

Others I've talked to say universal coolants can be used, but strongly encourage that a thorough flush and cleaning of the cooling system be performed first. And there are those who insist that only the OEM-specified coolant will do. Personally, I'm a fan of the latter but I'll leave the choice up to you.

The important takeaway I want you to leave here with today is that regardless of the claim on the bottle that the coolant inside is a "lifetime" fill, understand that the longevity of the coolant is impacted by the conditions it lives in. Missed leaks (internal or external), bad radiator caps, weak electrical grounds and other factors can all speed up the depletion of the inhibitor package each coolant formulation uses. And once it's gone, the interior destruction can begin.

So test your customers' coolants, not just for the pre-winter prep, but every time they bring it to you for service. It will add revenue to your bottom line while extending the life of your customers' second largest investment.

PETE MEIER is an ASE certified Master Technician with over 35 years of practical experience as a technician and educator, covering a wide variety of makes and models. He began writing for *Motor Age* as a contributor in 2006 and joined the magazine fulltime as Technical Editor in 2010. Pete believes in the mission of the magazine to "advance the automotive professional" and provides resources to working techs around the country through print, social media and YouTube.
pete.meier@ubm.com

THE STORY OF MASTER TECH SEWERA

A ZIMBABWE TECHNICIAN EPITOMIZES WHAT IT MEANS TO BE COMMITTED TO YOUR PROFESSION

PETE MEIER // Technical Editor

The story of Zimbabwe Master Technician Taurayi Raymond Sewera is so motivating that I asked him to share it, in his own words, with all of you:

My name is Taurayi Raymond Sewera. I grew up in a family of four boys and one girl living in the high-density suburb of Glen Norah in Harare, Zimbabwe, Africa.

I had a very tough life growing up where I could barely get three meals a day. My mother would sell hand-sewn clothes she made to take care of our family, while my father barely took care of our family most of my childhood life. He became more involved in our lives when I was 13 years old and passed on when I was 19. I became the bread winner for my family at the age of 20, and I started working on cars as the best way to provide for them. I am a self-taught automotive technician.

I would work on anything automotive that presented itself to me — from light gasoline, light diesel and even heavy-duty diesel vehicles, including earthmoving equipment. I started my

I HAVE MORE THAN 1,000 AUTOMOTIVE BOOKS in my personal library and study them nearly every night in my quest to become one of the world's best.

PHOTOS: PETE MEIER

FVP®

VERIFIED. PROVEN.®

REACH FOR WHAT WORKS.™

PLATINUM AUTOMOTIVE BATTERIES

The FVP Platinum Battery lineup:

- Engineered to meet exact OE fitment specs
- Backed by nationwide free replacement warranty
- Distributed by Factory Motor Parts

Visit FVPparts.com for more!

FMP

FACTORYMOTORPARTS™

WE SUPPLY YOUR SUCCESS.®

career selling vehicle spares — mostly used ones that I got from salvage yards. In the early part of my career, I was working in and out of a highly informal industrial place called Gazaland in the Highfield suburb.

At the age of 22, I got married to my beautiful wife, Faith. Two years later we had our first child, Chantell. Together, my wife and I have had five children. My growing family added additional responsibilities on my life as the family bread winner, and it pushed me to work even harder.

What has truly turned my life around was the decision to become a Born-Again Christian, and from that day I have never looked back. I made a prayer to the Almighty telling him how much I wanted to turn my life around and become one of the best automotive technicians in the world.

My quest to become one of the best took off in 2016 as I was watching a YouTube video of an American automotive instructor by the name of Jim Morton. The video was Mr. Morton teaching an ignition waveform diagnostics class at a TST (Technicians Service Training) event. At the beginning of the class, Jim wrote his email address on the board and I chanced emailing him, telling him of my desire. Fortunately enough, Jim replied my email and told me how he was impressed by my desire.

IF NOT FOR THE SUPPORT AND MENTORSHIP of my great friend, Jim Morton (right), I may never have discovered the opportunities events like VISION have to offer.

Jim told me that in order to become one of the best, I needed to attend one of the best automotive training events in the world — like the VISION Hi-tech Training event held every March in Overland Park, Kan. He also mentioned how unfortunate it was that I lived so far away because of the costs involved and what it would take for one to attend this event all the way from Africa.

Not to be discouraged, I told Jim I was 100 percent dedicated to automotive technology training, and I was willing to pay for all the costs to attend this legendary event. Jim managed to link me up with Sheri Hamilton, the Executive Director for VISION. Sheri was very happy to help and provided me with all the necessary paperwork to facilitate my USA Visa so that I could attend VISION.

I became the first and only African to ever attend VISION in 2017. And I've attended every year since. While I was at the 2017 VISION Hi-Tech training event, I received an award for the furthest travel ever by a VISION attendee. But the award is nothing compared to my experience in attending. I cannot thank Jim and Sheri enough. It has changed my life and my ideas of what being the best really means. It has provided me with the opportunity to attend classes from the world's greatest instructors like John Thornton, Bernie Thompson, Scot Manna, G. "Jerry" Truglia, the late Harvey Chan, Scott Shotton, Matt Fanslow and many more I don't have the room to mention. I was also fortunate enough to meet great techs from

around the United States and others from countries around the world. Attending VISION really impressed on me how much technology is changing in the automotive industry and the need to receive as much training as possible every year. Most of the training available at events like VISION, the TST "Big Event," "Super Saturday" and many more cannot be found in textbooks. It is the latest information and techniques that are developed by these great instructors and technicians, earned as they work on cars every day.

There is no substitute to these "live" automotive training classes. If one wants to be the best one can ever be, one ought to attend these training events. I believe the training offered at these events does not cost, but pays. Ever since I started attending training events like VISION, I learned that I cannot afford to miss it even though I travel over 9,000 miles one way to the USA.

It is the best decision I have ever made in my 21-year career as an automotive technician. I have also decided to take ASE exams every time I travel to the USA. I have managed to take all nine automotive certifications offered to become an ASE Master Automobile Technician. I have also managed to pass ASE Advanced Level Specialist in Engine Performance (L1), Medium Electronic Diesel (L2), Hybrid and Electric vehicles (L3), Undercar Specialist (X1), and I am also currently ASE certified in five systems related to medium and heavy-duty trucks.

At the time of writing this, I am about to travel to Massachusetts for a hybrid and electric vehicles internship with ACDC, owned by Craig VanBatenburg. While I am there, I will be taking additional ASE tests, including three systems in medium and heavy-duty trucks to become a Master Technician in that category. I am also going to take 16 more ASE tests to become ASE Master Technician in Truck Equipment, Collision Repair/Refinish and Transit Bus. I am currently left with only seven ASE systems to be recognized as an ASE World Class Technician!

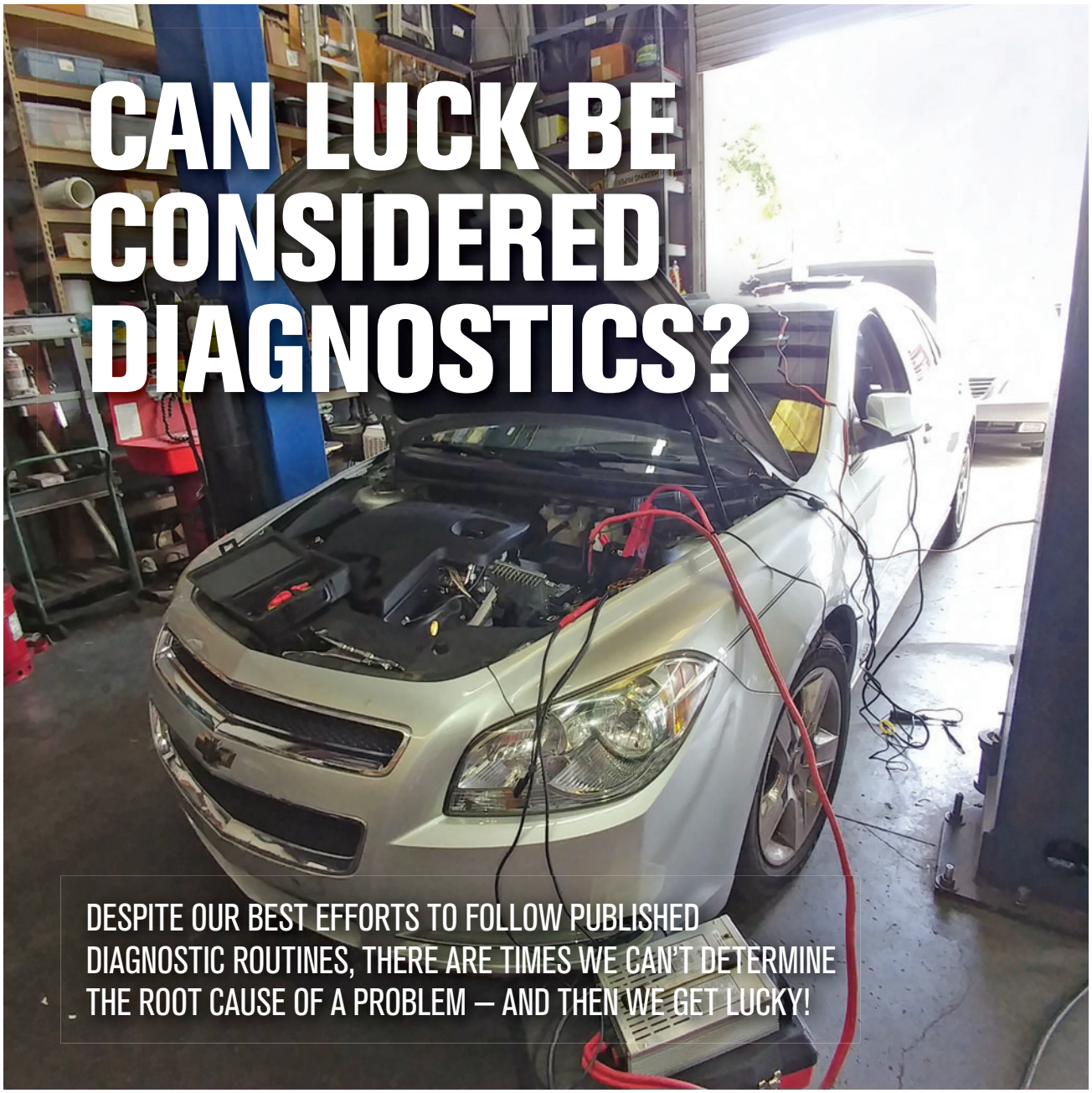
It seems to me that, with so many great training events held every year in the USA, most American technicians take training for granted. I hope you will gain inspiration through my journey as an automotive technician. I believe there is no appropriate excuse for not going to these training events. I also hope you appreciate how fortunate you are to be exposed to these extraordinary training events.

I also urge you to go and take ASE tests in support of this incredible accreditation. After all, it's all we have to highlight our efforts to be total professionals. If only you could imagine what it's like to travel to the USA or Canada just to take these tests. I come from Zimbabwe, which is one of the poorest countries in the world, but still manage to save my hard-earned money to travel to America for both training and ASE tests.

To me, training is very personal. I take it to heart. There is nothing I love more than training and to have all the knowledge to work on the latest technology vehicles including hybrid and electric vehicles. I am by no means wealthy — it is all in pursuit of knowledge. I just want to be a better technician every day and will do anything to save money and find the time to attend these phenomenal training events.

I have more than a thousand automotive-related training books in my collection. I got most of them from auto tech friends I met when I attend training events in the States. In addition to attending the training events, I study these books from 11 p.m. to 2 a.m. almost every single day — all to hopefully one day realize my dream of becoming one of the world's greatest techs!

PETE MEIER is an ASE certified Master Technician with over 35 years of practical experience as a technician and educator, covering a wide variety of makes and models. He began writing for *Motor Age* as a contributor in 2006 and joined the magazine fulltime as Technical Editor in 2010. Pete believes in the mission of the magazine to "advance the automotive professional" and provides resources to working techs around the country through print, social media and YouTube. *pete.meier@ubm.com*



CAN LUCK BE CONSIDERED DIAGNOSTICS?

DESPITE OUR BEST EFFORTS TO FOLLOW PUBLISHED DIAGNOSTIC ROUTINES, THERE ARE TIMES WE CAN'T DETERMINE THE ROOT CAUSE OF A PROBLEM — AND THEN WE GET LUCKY!

JAIME LAZARUS // Contributing Editor

Are you superstitious? I must admit that I am, just a little bit. What harm does it do to toss a pinch of salt over your shoulder after you knock the salt shaker over on the table? However, if you "knock on wood" to ward off evil spirits and something never happens, does superstition have anything to do with it? Some folks call that good luck, and therefore, it has nothing to do with superstition.

The days of the Chevy Vega

When I was very young and impetuous, I successfully drove across the country. Some of you may have also done so when you were 21 as well, and most of you will think, so what? Well, I did it in a 1972 Chevy Vega. Do any of you older folks now affirm that it was, indeed, quite a feat? Those younger might not know how problem-prone those cars were, but I can assure you that they most certainly were.

It was on the second day of our trip when the car started to surge at a steady

PHOTOS: JAIME LAZARUS

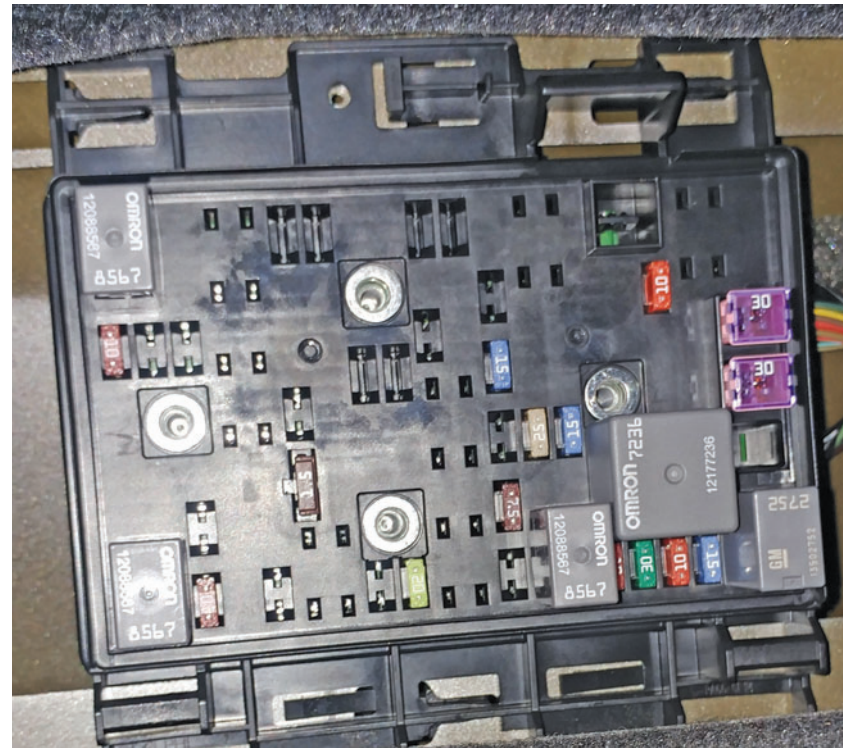
KNOWING IF YOU'RE WORKING WITH A CURRENT DTC is important when making an accurate and efficient diagnosis.

FUSES AND RELAYS AREN'T ALWAYS POSITIONED so that their labels all face in the same direction. The Starter Relay is attached to this Fuse/Relay center.

throttle. Having not even made it halfway across the country (West Texas, to be precise) before trouble occurred, it was not a good sign of how the rest of the trip might end up! The surge went away if I accelerated or decelerated. As it got later into the day, the surge continued to get worse. My wife and I were getting worried, so I pulled off to the side of the road to see if I could determine what was causing the problem.

A visual inspection revealed nothing was obviously wrong. The surge was dramatic at idle, causing the RPMs to raise and lower, but not rhythmically, and the engine was running very rough.

Tired, hot and exasperated, this inexperienced mechanic leaned against the air filter housing — and to my surprise the engine smoothed out. Completely surprised by what had happened, I lifted my hand off of the air filter and the engine started stumbling again! I repeated



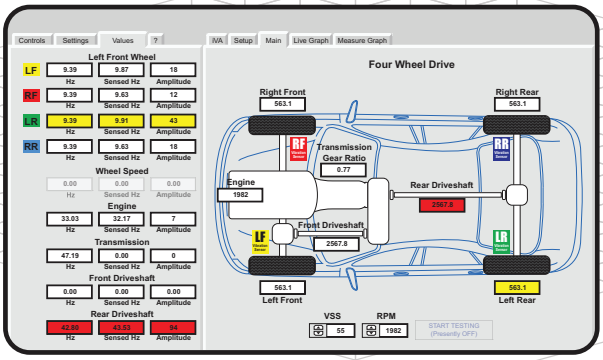
THE FUEL PUMP RELAY is attached to this Fuse/Relay center.

iVA™

Intelligent Vibration Analyzer

Patent Pending

The Next Level in Vibration Analysis



Quickly pinpoint where the vibration is coming from

- Which Wheel/Suspension (LF-RF-LR-RR)
- Which Brake (LF-RF-LR-RR)
- Which Driveshaft (Front- Rear)
- Engine and Engine Driven Pulleys
- Transmission and Transfer case

iVA uses Quad Vibration Technology™ (QVT) to locate and identify the vibration then rate the vibration severity with advanced color coding. The iVA can locate multiple vehicle vibrations simultaneously.

Easy • Quick • Accurate

ATS | AUTOMOTIVE Test Solutions

Proud to be a U.S. based company

automotivetestsolutions.com

800.572.6112

Available at AE TOOLS & COMPUTERS · NAPA AUTO PARTS · WORLDPAC Wholesale Distributor of Original Equipment Automotive Parts · Advance Auto Parts

my actions several times to make sure it was not just coincidental.

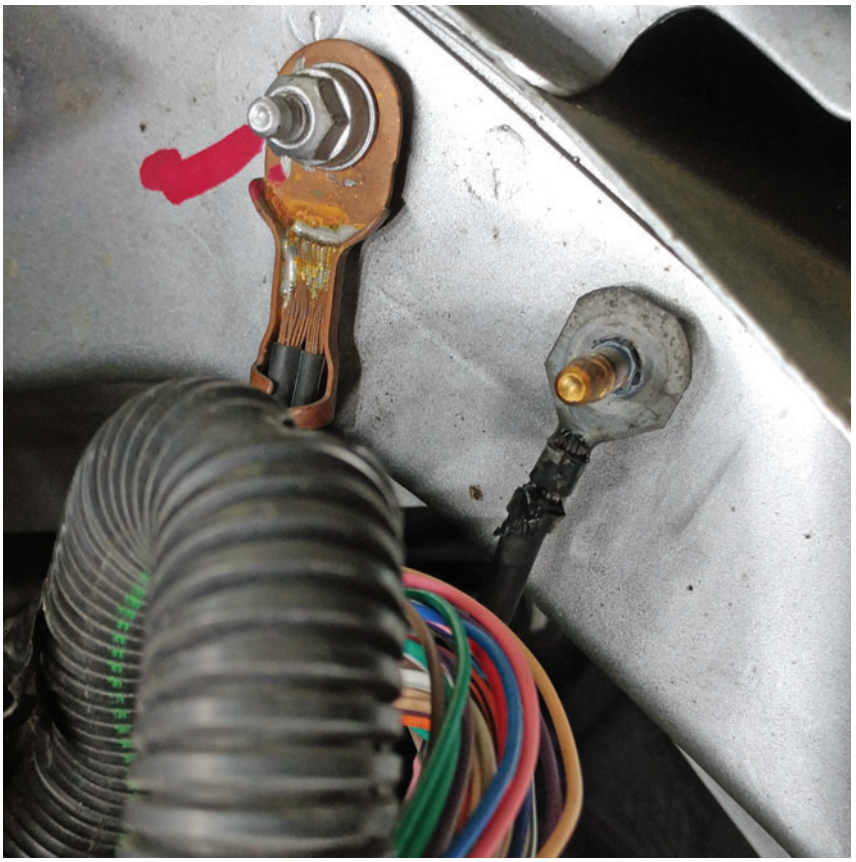
I shut off the engine and took the air cleaner assembly off of the carburetor. I noticed the top two-thirds of the carburetor was loose because screws that passed through the throttle body into the underside of the carburetor bowl had vibrated loose and backed out. Air was bypassing the carburetor's venturi between the two loose parts, causing the engine to surge. On acceleration, the carburetor was enriching the mixture enough to prevent a surge. On deceleration, a high-intake vacuum pulled the loose parts together. While cruising, there was too much air entering the intake for the amount of fuel delivered. After performing an emergency repair, I felt fortunate and continued on my way.

Found by accident?

Have you ever accidentally found the solution to a diagnostic problem? Have you ever gotten that lucky? I think all of us experience that every now and then. As a matter of fact, very recently it happened to me again. In my defense, I tried to fix this 2011 Chevrolet Malibu LT with a 2.4L, DOHC, 16v engine and 4-speed automatic transmission the right way, based on the information the vehicle provided, but that information led me nowhere near what was causing the problem.

The customer complaint was "check engine light on" without experiencing any problems driving it. The vehicle arrived in the shop with five ECM codes, three in the Power Steering Control Module, one in the Vehicle Theft Deterrent Module and two in the Generic OBDII side. It was quite obvious that some electrical faults were present recently. The technician cleared all codes out of all modules and found the ECM would immediately set two diagnostic trouble codes (DTCs) as soon as it was started.

CLEARLY OBVIOUS IS THE MISALIGNED FACTORY MARKING the outboard (left) ground to the core support, indicating it had been tampered with. A clearly overheated terminal is attached to the inboard ground lug.

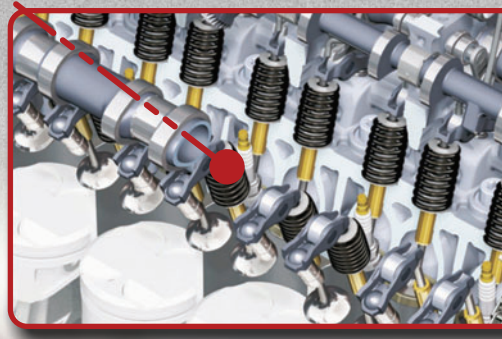


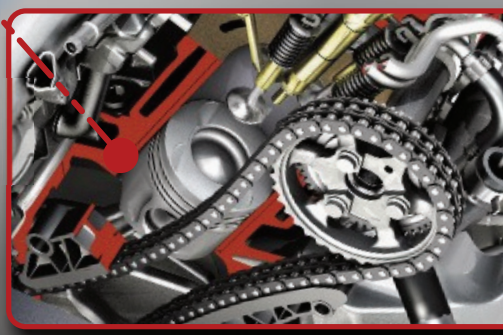
MELTED INSULATION NEAR THE WIRE TERMINAL is proof of the extreme heat it suffered.

Naturally, the shop eliminated all of the basic causes for so many problems, such as a bad battery or faulty alternator before calling me. I did some research for them and found a technical service bulletin (TSB) referencing chafed wires underneath the rear

WTI
WORLDPAC Training Institute®

WORLD Class Training



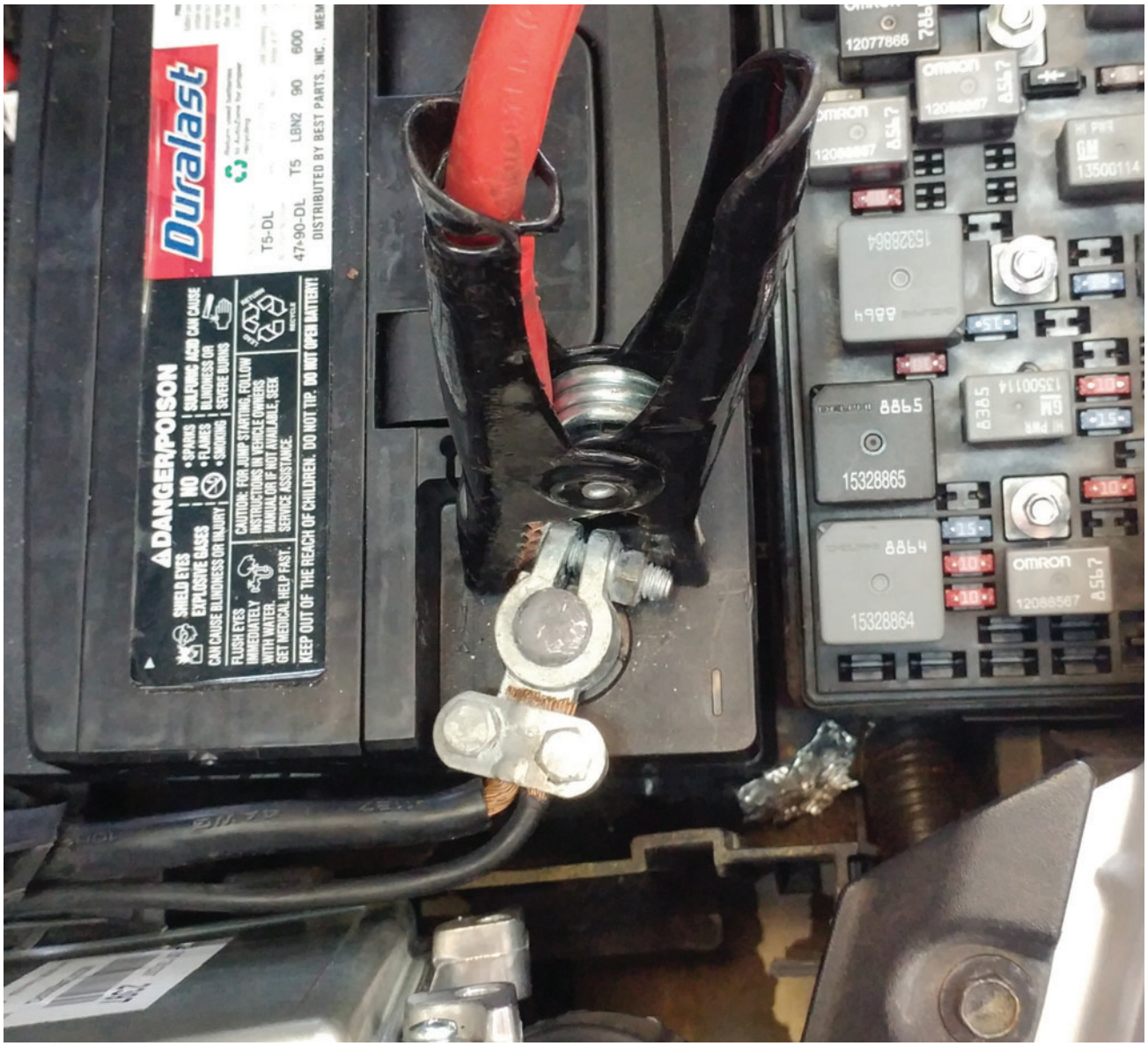


NEW!
Additional Classes Being Announced Soon!

Sign up for WTI emails today!
www.worldpac.com/notifyme

From advanced level hybrid training to managing your financial statements to Porsche M96 engine management classes, the WORLDPAC Training Institute (WTI) offers independent automotive professionals the **finest technical and business training available.**

www.worldpac.com/wti
USA (800) 888-9982 ext 5470
Canada (800) 644-9129



THE NEGATIVE BATTERY CABLE AND TERMINAL had been replaced in the past, likely at the same time the core support grounds were tampered with.

seat, which may cause multiple faults, DTCs and/or customer complaints. The shop technician checked the harness in question and found absolutely nothing wrong with it.

The two Engine Control Module (ECM) DTCs, P0615 Starter Relay Control Circuit and a P0230 Fuel Pump Relay Control Circuit, were shown on the scanner as stored in history and are current codes. After the technician spent several hours attempting to find a cause for the two codes (that would not clear), he then requested a time for me to visit so that I could program a replacement ECM.

There were several attempts I made, and each time I was shown a different error message while attempting to program that module. I reinstalled the original ECM but experienced several more errors while attempting to program it. It was time for me to perform some diagnostics.

Getting a hand on the problem

It seemed very odd to me that the car cranked and started up as if there were no problems, yet we had hard codes for the starter circuit and fuel pump circuit. I began with a visual inspection. I noticed some of the relays with their writing in the opposite direction of all others. That immediately raised a suspicion that somebody else had been here before me. I looked at the service information wiring diagram — and the diagram printed on

the relay — and determined both relays were installed incorrectly. I thought to myself how lucky is that! I cleared codes with a smile from ear to ear.

My elation quickly changed when I still had the same codes setting again after I started the car. The shop owner asked if I had any luck. I answered, "Yes, all bad." After all, being unlucky is one form of luck isn't it?

As a side note, those relays made no difference in the way the car started and ran. Don't ask me why reversing the direction of the relay makes no difference.

I began following the troubleshooting charts for both DTCs, which led to "Replace and program ECM," the same as the shop's technician determined. I didn't believe that conclusion after what I'd tested already. The technician and I spent a few moments going over each of the steps that we both had performed and having obtained the same results, we were perplexed.

ARCING IS EVIDENT ON THE GROUND LUG.

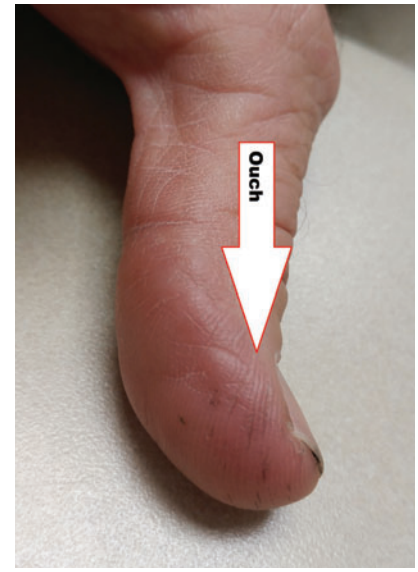
THE AFTERMARKET NEGATIVE BATTERY CABLE TERMINAL clearly does not fit like the original at the engine's location (and shows evidence it may not have been properly torqued).

Tired, hot and exasperated (and like before, with no direction to go on) I leaned on the core support — and immediately pulled my hand back off. It was hot enough to burn my thumb, which was unusual, because the engine had not been run for several hours. I was doing testing with the key on, engine off!

Although when I initially saw it, I paid very little attention to the fact that the negative battery cable had been replaced. It was obvious because of the aftermarket battery terminal connection. Now, however, I focused on that previous repair! A closer inspection of the ground terminal on the radiator core support revealed it had suffered heat damage from a loose installation. No further testing needed to be done. I replaced the wire terminal and relocated it to the stud next to it. I then cleared codes and started the engine. Rechecking for any DTCs proved none were present.

The clues I had earlier — the DTCs the shop recorded when the car arrived (then cleared) — could have led me to this sooner if I would have prioritized one of them (a P0315 "Crankshaft Position (CKP) System Variation Not Learned"). It has been my experience that when a computer claims that crankshaft variation has not been learned that there has been a cause for its amnesia. It was this problem that I could have attempted to address first. However, history codes are just that. They occurred sometime in the past; nobody knows when. I could have also wasted a lot of time with that testing, too.

Once I repaired the radiator core support ground, I performed several different tests on the ECM power supplies battery, the ignition feeds and all of its grounds — which all passed. I called this job done!



ONE OF OUR DIAGNOSTIC TOOLS can be our sense of touch.

Whether it's called diagnostics or it is called sheer luck matters NOT when the ultimate result is that the car is repaired. There was absolutely no mention of it in the diagnostics — for either recurring DTC — instructing the technician to check the battery grounds. My finding a poor connection, that once repaired solved the problem, was purely good luck. I'll take luck over a non-billable diagnostic session any time! Oh, and my thumb healed quickly.

By the way, it was that trip I took in my younger years from California to Florida that got me my first mechanic job. The shop owner said if I knew enough to make a '72 Chevy Vega go across country in just five days that I "must know something!" He hired me on the spot! MA

JAIME LAZARUS has regularly presented technical seminars since 1985. He recently taught instructors at the North American Council of Automotive Teachers conference and the NASCAR Technical Institute.
jlazarus1@cfl.rr.com

LIFT TRAINING AT YOUR FINGERTIPS

BendPak endorses ***Lifting It Right***, the ONLY training program developed by industry safety watchdog Automotive Lift Institute (ALI) and based on more than 70 years of experience in protecting technicians. One-time enrollment with auto-renewal means you "set it and forget it!"

*$240 annual pass gets you:

- Unlimited access to ***Lifting it Right***
- Full participation for your entire team
- Official ALI safety training
- Significant cost savings
- Online record storage
- Easy compliance with training requirements

Order now at **www.autolift.org/ALI-STORE**

ONE EASY PAYMENT!

*Subscription per facility

AVAILABLE IN SPANISH

LIFT IT RIGHT OR DON'T LIFT IT AT ALL!

AUTOMOTIVE LIFT INSTITUTE ALI MEMBER

Providing safe and innovative lifts for over three decades

BP BendPak

NO MORE GUESSWORK

3D Quick-Touch™ Data Entry

Dual Laser-Spot™ Technology

Includes **FREE** Wheel Weight Starter Kit

ASSURANCE 24 MONTH WARRANTY

MRP $3,420
FREE SHIPPING*

Exclusive Laser-Spot™ technology **precisely targets** weight placement locations, helping to achieve the perfect balance every time. No guesswork. No re-spins. **Ranger makes it that easy.**

1-800-253-2363 ▪ bendpak.com/laser

*Free shipping on Ranger products to the 48 contiguous states.

Ranger

MaxiIM IM608: Diagnostics & Key Programming Tablet

Autel's MaxiIM IM608 is an advanced diagnostics, service, and immobilizer and key programming touchscreen, Wi-Fi tablet. The 10-inch Android-based features all the diagnostic capabilities found on Autel's advanced MaxiSYS MS908 tablets including AutoVin detection, all-system AutoSCAN diagnostics, active tests, special functions, coding, initialization and memory relearns. The IM608 is compatible with domestic, Asian and European vehicles, 1996 and newer.

Autel's diagnostic tablets are renowned for their data-rich systems performance details including Freeze Frame and Live Data and all this information is available on the IM608 as well. The IM608 also features a comprehensive Service menu that includes common maintenance services to more sophisticated sensor to system resets and relearns. Hot function services include Oil Light Reset, DPF Regen, EPB and Steering Angle Sensor resets, Brake Bleed, Battery Maintenance, Throttle Positioning and Seat Occupancy Sensor reset. The tablet includes the MaxiFlash JVCI for vehicle communication and J2534 flash programming.

The IM608 includes the MaxiSYS Shop Manager and Data Manager applications making it an ideal customer and vehicle management aide. The tablet offers wireless printing and software updating and can access diagnostics and key programming websites directly from the home screen.

When it comes to key programming and immobilizer functions, the IM608 is Autel's most advanced tool with expert-level IMMO and key programming functionality including the ability to perform Add/Remove/All Keys Lost key-learning on domestic, Asian and European vehicles.

The IM608's efficiency cannot be overstated, as it enables key learning directly through the OBDII port for 85 percent of vehicles in North America. The tablet can read the immobilizer pins and password directly from the vehicle and store this information to use later when learning the newly programmed keys to vehicle. The tablet is a complete resource for every step in the key programming process by providing detailed, vehicle-specific data such as the number keys currently assigned to vehicle and the key type, style and description.

The IM608 includes the XP400 key and chip programmer to read/write and learn keys to the vehicle. The XP400 enables programming of infrared keys for Mercedes vehicles and IC Chip keys on some of the new Hyundai Kia vehicles. The XP400 also performs EEPROM-data functions needed for European vehicles.

The IM608 is designed to make key programming stress-free with its step-by-step guided instructions and its free technical support available via telephone, chat and email. Choose between Smart or Expert Mode depending on the operation and your comfort level with the procedure. The IM608 is packaged in a sturdy blow-molded case to securely store the tablet, JVCI J2535 pass-thru programming device, XP400 key programmer and needed cables and adapters.

The tablet includes one year of free software updates to ensure the tool can be updated with the latest functionality and to remain compatible with the latest vehicle releases. The tablet is covered by a one-year warranty.

AUTEL®

AUTEL
175 Central Avenue, Suite 200
Farmingdale, NY 11735
855-288-3587
USsupport@autel.com
www.Autel.com

Parts Plus Car Care Centers repair more vehicles faster

The right kind of repeat customer

Repeat customers are a shop owner's dream. They come in regularly for routine service and always turn to you when there's a problem — they may even recommend your shop to friends and family.

But customers coming back to the shop, complaining the issue hasn't been fixed? That's something all shops want to avoid.

Besides offering stellar customer service and care, properly diagnosing and repairing a vehicle is essential to shop profitability, meaning your tools need to be reliable and based on factual data.

Parts Plus Car Care Centers choose to use Direct-Hit from Identifix, the largest and most reliable online database of service and repair information. Using Direct-Hit is the fastest way to get to the repair information they need for any vehicle issue; all information is searchable by keyword, so you don't sacrifice essential repair time riffling through manuals. You can search by vehicle, symptom or ODB2 code to find the right fix.

The right repair, every time

In an independent study, professional vehicle technicians were able to diagnose a vehicle's issue with 100% accuracy with Direct-Hit compared to two industry competitors. No matter what breaks on which vehicle, Direct-Hit is the fastest way to figure out what's wrong and how to fix it.

Beyond OEM information, Direct-Hit has a database of more than 2,500,000 fixes confirmed by ASE-certified master technicians. By providing real-world fixes and technician-confirmed repairs, Direct-Hit provides users with instant solutions to both common and head-scratching vehicle problems. Parts Plus Car Care Centers turn to Identifix when they're stumped on an unusual fix. It is the best way to gain more repair knowledge and contribute to their own experiences with, say a finicky ABS light or a mystery noise. Rather than working through diagnostic flow charts and other tests, you gain access to the precise information you need to get vehicles back on the road, confident the customer won't be returning for the same issue.

The bottom line

Your shop needs a tool that can save your business time, reduce costs and instill confidence for your customers that they made the right choice coming to you. Technicians using Direct-Hit save an estimated 16 hours per month, an enormous cost savings for a shop.

Direct-Hit delivers all data, tools and information necessary to help Parts Plus Car Care Centers to run their shops as efficiently, accurately and profitably as possible–every day and on every car. Using Direct-Hit means more vehicles, less time and increased performance of both your technicians and the shop as a whole.

The Direct-Hit system includes:

- OEM direct remove/replace procedures
- OEM direct component locations
- Colored wiring diagrams
- Diagnostic trouble codes (DTCs)
- OEM direct technical service bulletins (TSBs)
- Specs and capacities
- Estimating tools
- Labor guides

Direct-Hit saves on diagnostic time, gives you access to common problems, which in turn sharpens your techs' skills, and extends the life of your customers' vehicles. Bring back those repeat customers with quality repairs and fast, accurate service every time.

To learn more about Identifix's suite of solutions, visit identifix.com.

Visit **www.partspluscarcarecenter.com** today to view additional benefits available to your shop and customers.
Email: **ccc@networkhq.org** | Call: **(800) 727-8112**

Solera | IDENTIFIX

PARTS 4 PLUS CarCareCenter

Servicing hybrid battery cooling fans

Unlike your typical HVAC fan, a hybrid vehicle battery cooling fan has a much tougher job. It operates almost continuously while the vehicle is in use, taking cool air from the passenger compartment and circulating it over the battery cells. Battery cooling is a critical function in maintaining optimum battery health and service life. If the cooling fan goes out of spec, it should be replaced, because it can cause the hybrid battery pack to overheat and wear out prematurely.

However, before you replace that battery fan – here are some repair tips to keep in mind that will help you service the battery properly and avoid causing permanent damage to your new fan unit.

Tip 1: Follow manufacturer's instructions. Failure to comply with the manufacturer's safety and general recommendations may result in serious personal injury or damage to the vehicle.

Tip 2: Check the VIN. You should confirm that you have the correct fan for the exact year, make, and model of the vehicle. This is especially important as the model year and build year can be different.

Tip 3: Do not bench test the new fan. Hybrid cooling fan motors require special tools to generate a signal at the factory specified voltage. Using a 12-volt source, such as a battery charger, is not recommended and can permanently damage the fan.

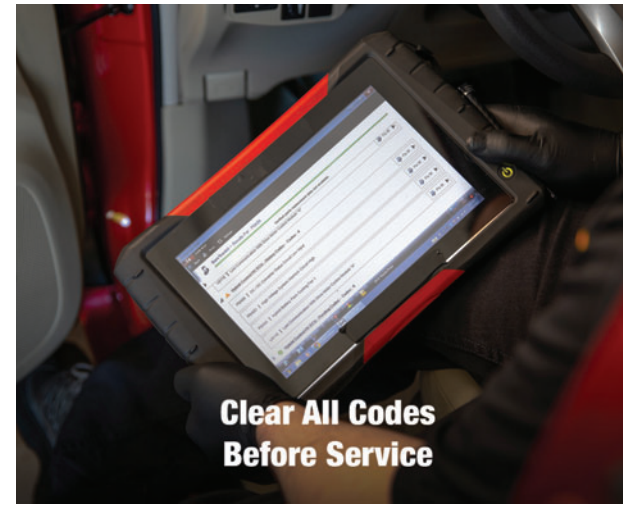
Tip 4: Check and clear any OBD codes. Failure to clear a fan related code before starting the service can cause damage to the new fan. Although codes can vary by manufacturer, battery pack deterioration and a stored code such as P0A84 require urgent attention as they can lead to reduced power or complete deactivation of the electric propulsion system. Follow manufacturers recommendations for handling codes specific to the vehicle.

Tip 5: Maintain a regular service plan. The best practice for hybrid vehicle battery longevity is a good maintenance schedule. Perform the proper maintenance, keep the battery regularly charged, and avoid extreme temperatures, whenever possible. Hybrid battery warranties typically run eight years, although some manufacturers go longer.

As with any battery, how it is used and charged are key factors in hybrid battery life expectancy. Irregular charging, long periods of exposure to extreme temperatures, and preventing the battery from becoming completely discharged can reduce battery service life.

These helpful tech tips are presented as a courtesy of Continental, manufacturer of VDO Hybrid Battery Cooling Fans and first to market with many popular vehicle applications.

For more info, check out our video at: youtube.com/watch?v=1a57pT55x6U or contact: salessupport-us@vdo.com.



Continental

Active Fuel Management can pose challenging diagnostics

By **LARRY HAMMER,** Technical Services, Mighty Distributing System

Chirping, ticking, squealing or squeaking sounds accompanied with misfire codes stored may be the result of valve lifter or camshaft failures on vehicles equipped with Active Fuel Management (AFM). Pinpointing the source of the noise can be a challenge for the technician and the repairs can be costly.

Some noises can be identified and resolved, while others fall into a category of "it's a normal characteristic." At least that is the position of some vehicle manufacturers. Some engines are prone to make noises. For example: Clicking, ticking or knocking sounds on cold starts; a brief piston slap for 2-3 minutes following a cold start in cold weather is not detrimental to the life of the engine; fuel injector and fuel pump clicking/ticking noises are normal on vehicles equipped with Gasoline Direct Injection, as the system operates at extremely high fuel system pressures.

GM's AFM system

The AFM system has the ability to turn an 8 cylinder engine into a 4 cylinder for fuel efficiency during light load conditions. Special AFM valve lifters with locking pins are controlled by oil pressure via a Valve Lifter Oil Manifold (VLOM), which incorporates four electrically controlled solenoids that direct pressurized oil to the AFM lifters when cylinder deactivation is commanded by the PCM and blocks the oil flow to the lifters to reactivate the canceled cylinders.

Camshaft and Lifter Failures... Valvetrain issues with the AFM system prompt complaints of chirping and squeaking noises accompanied by a Check Engine light and stored misfire codes. The symptoms may occur intermittently or consistently. These noises normally increase off-idle and occur at camshaft speed, which is half of crankshaft speed. The symptoms may be the result of the following: 1) Worn camshaft lobe; 2) Valve leakage; 3) Sticking valve; 4) Broken valve spring; 5) Collapsed or stuck AFM lifter; 6) AFM lifter locking pin damage/failure due to oil aeration; or 7) Damaged lifter guides allowing valve lifter roller misalignment with a camshaft lobe.

Lifters stuck in the compressed position may be the result of cylinder activation during improper position of the camshaft lobe. Activation should occur when the lifter is at the base of the camshaft lobe and not on the ramp or lobe peak. If the AFM lifter unlocks as soon as the engine is started, low compression will result on that cylinder and a misfire code stored. Collapsed or stuck AFM lifters due to contamination will result in the same. Contamination/sludge is a major concern, prompting some to re-think mileage service intervals.

A Visual Inspection... If diagnostic procedures fail to identify the source of the noise or misfire codes, a visual inspection of the camshaft and lifters may be necessary. During the inspection, it is not uncommon to identify a worn camshaft lobe, stuck or damaged AFM lifters. Consider the following: 1) Lifter rollers may encounter pitting or gouging with a crater like appearance; 2) Flat spots on a lifter roller is an indication of lifter guide wear, allowing the lifter to rotate in the lifter bore and becoming misaligned with the camshaft lobe. Replace any lifter guide that encounters worn or damaged lifters or camshaft lobes; and 3) The camshaft may encounter lobe wear due to lifter failure, which often requires removal of the camshaft for a visual inspection.

There is a small filter screen positioned in the VLOM beneath the oil pressure sensor that can affect AFM operation due to sludge buildup, thereby restricting oil flow. If you are not familiar with the filter, review Mighty Tech Tip 185 "Low Oil Pressure Message" on our website.

MIGHTY DISTRIBUTING SYSTEM OF AMERICA
650 Engineering Drive, Norcross, GA 30092
Phone: 800.829.3900
www.mightyautoparts.com

Tips to help you find the fix faster

With so much complexity in today's vehicles, auto repair technicians have much more to think about than just keeping the engine running. Everything in the car is more complex — even changing a headlamp is not the simple operation it used to be.

ADAS (Advanced Driver Assistance Systems) features like pedestrian detection, adaptive cruise control and electronic scanning radar are already becoming standard in vehicles that aftermarket shops must be prepared to service and repair.

So much information, so little time

The exponential growth of complexity has brought not only an explosion of information needed to repair vehicles, but also a proliferation of sources to access that information. Juggling all of these sources can be a time-consuming challenge, often with no way to verify the data is correct. The issue for technicians is no longer about availability of data to fix cars, but how to find the correct data — and more importantly, how to find it *quickly*.

What has *not* changed is the need to keep cars moving through the bays. Customers still expect to have their car back the day they drop it off, or at latest by the next day. So the pressure is on auto repair shops to be as efficient as possible. One thing that can help is being able to access comprehensive, reliable repair information from a single source.

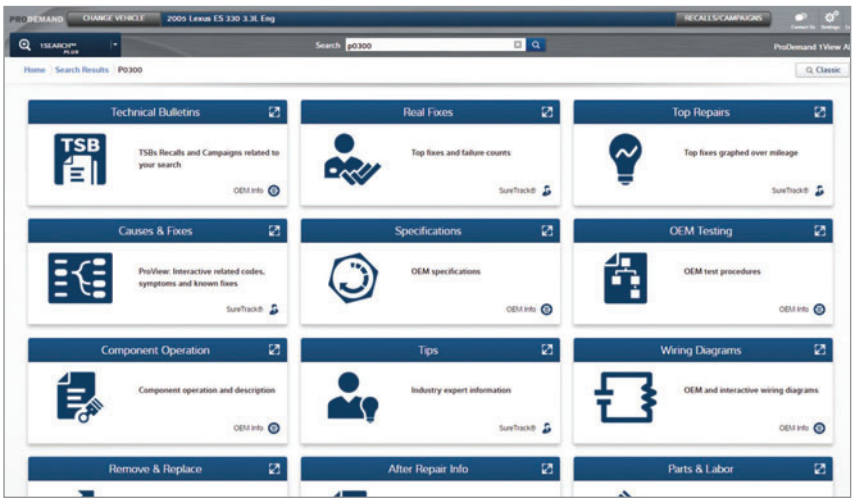
Single search, comprehensive results

ProDemand® from Mitchell 1 is designed to do just that, taking efficiency to the next level. In a single lookup, ProDemand delivers complete and verified OEM repair and maintenance information, diagnostic trouble code data, and powerful SureTrack industry-based knowledge sourced from millions of actual repairs.

But again, the challenge is to present all this information in a way that lets technicians find what they need quickly. That's where the 1Search™ Plus feature in ProDemand can help. This advanced search engine and user interface returns targeted results in a graphical card layout organized into specific categories, so all relevant information is always just one click away.

After a search, cards are returned according to a technician's natural diagnostic workflow. TSBs are returned first so techs know right away if there is common fix information from the OEM. SureTrack diagnostic information follows next, with industry-based content from professional technicians and aftermarket shops that sets the technician on the right path to an accurate diagnosis. Once the tech has properly diagnosed the problem, they can then use the OEM removal and replace, and after-repair calibration or reset procedures to finish the job.

There's no doubt that vehicles are more complex than ever and technology will continue to accelerate. But technology has also inspired a new generation of repair information tools that help simplify the repair process from diagnosis to completion.



1SEARCH PLUS CARDS in ProDemand guide technicians to the specific information they need.

Making valuable use of the 8-channel PicoScope 4823

Why do you need an 8-channel automotive oscilloscope?. Here's one example.

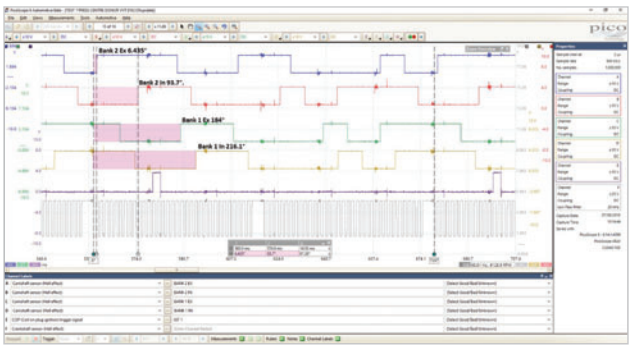
It's a quad cam engine (Toyota 2GR-FE) with a repeat fault code P0016 suggesting a camshaft correlation error for Bank 1 Intake. A static manual inspection confirms alignment of all relevant timing marks, but doesn't show the effect of load!

With the addition of VVT actuators, multiple camshafts, gears, idlers, and timing chains, how can we be sure the valve timing remains true when the engine is running?

Correlating measurements between four camshafts and the crankshaft on a quad cam engine requires at least five channels. The PicoScope 4823 gives us eight. We'll use a sixth input for a cylinder 1 synchronizing ignition event.

Below is the repair vehicle at idle with all VVT-i controllers disconnected and the camshafts in their default positions. Highlighted are the first rising edges of each camshaft after the missing crankshaft teeth that form the inspection points for camshaft and crankshaft correlation measurements.

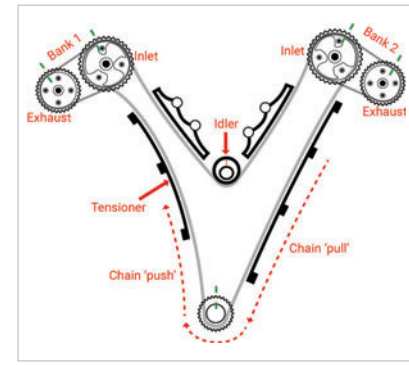
What does a good waveform look like? Here's a similar vehicle with the 2GR-FE engine for comparison.



This shows significant deviation in the correlation between vehicles for Bank 1 camshafts. Since our comparison vehicle has no camshaft correlation fault codes, our repair vehicle Bank 1 camshafts must be retarded by about 4°! How is that possible? Our static valve timing check showed no error.

Let's recheck the static valve timing alignment again. This time, instead of measuring timing mark alignment with the bright links located as before, we rotated the engine clockwise several times, then counterclockwise, before a final rotation in the clockwise direction. Now, the alignment of Bank 1 timing marks looks suspicious and inconclusive, so it's time to remove the engine and inspect the timing chain assembly.

We discovered excessive eccentric wear of the timing chain idler sprocket, allowing the tension between Bank 1 inlet camshaft and the idler to periodically "relax" (depending on engine load), causing camshaft timing deviation.



Removing the idler confirmed shell bearing wear due to lubrication starvation from a contaminated oil passage to the idler shaft.

We were puzzled that the only fault codes recorded for this vehicle referred to Bank 1 camshafts. Why was there never fault codes for Bank 2?

Further examination revealed the location of the timing chain idler sprocket kept the chain taut on the right-hand side (Bank 2) due to the clockwise rotation of the engine generating a near-permanent "chain pull", but relaxed on the tensioner side (Bank 1) due to "chain push".

Replacing the timing chain idler sprocket, shaft, bearing, chainset and associated consumables corrected the problem without further issues.

In this case, having the extra inputs from the PicoScope 4823 and the comparison waveform was critical in identifying the camshaft correlation issue. Read the full case history on our website: https://www.picoauto.com/library/case-studies/engine-warning-light.

SKF Flange kit offers solution for worn-out wheel bearing

Tech tip addresses 2007-2013 Jeep Compass and Patriot as well as 2007-2012 Dodge Caliber

SKF Flange kit BR930558K offers a solution when a worn out bearing needs replacement on 2007-2013 Jeep Compass and Patriot as well as 2007-2012 Dodge Caliber.

When replacing a worn-out wheel bearing, the wheel flange is often overlooked as the source of the bearing failure. Flanges that are bent or cracked will cause additional load to the bearing. SKF recommends doing a visual inspection and runout check of the wheel flange.

Damage to the wheel flange can also occur during removal. This can occur when the inner ring of the bearing is still attached to the flange after removal. In order to remove the inner ring, it needs to be cut off the wheel flange or pressed off. The cutting process can create scaring and jeopardize the integrity of the flange. The best process is replacement with a new bearing and wheel flange.

Currently, OEMs only offer an expensive option that comes with a knuckle assembly and backing plate. SKF offers a professional replacement kit that saves potential comebacks, time and cost. Only the necessary wear parts are included for replacement. The kit includes a wheel flange, wheel bearing, retaining clip and axle nut.

OEM KNUCKLE ASSEMBLY

A premium hub bearing kit in the aftermarket

To avoid the risk of purchasing various replacement parts individually and from different suppliers, consider choosing the SKF all-in-one hub flange kit. The kit includes all the parts needed for a hub reassembly, including a cartridge-style wheel bearing, c-clip, axle nut, seals and hub flange. Engineered to meet rigorous OE specifications, SKF's premium parts are designed to fit and work properly the first time.

SKF FLANGE KIT BR930558K

SKF YouTube channel offers in-depth technical videos

The SKF Vehicle Service Market YouTube channel offers a number of in-depth product and technical training videos designed to provide users with the information they need to conduct vehicle maintenance and repairs. Visit www.skfpartsinfo.tv to see more technical training videos or follow us on Twitter @skfpartsinfo.

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

Snap-on Introduces its Secure Vehicle Gateway Solution for FIAT Chrysler Automobiles

Automobile manufacturers are developing solutions to protect their vehicles' networks from unauthorized access, including potential cyber-attacks. FIAT Chrysler Automobiles (FCA) recently implemented a secure gateway module that was introduced on a selection of their 2018 and newer model vehicles. For those vehicles with the secure gateway module, access to certain diagnostic functions requires registration and authentication through an approved device for all aftermarket scan tools.

With its newest software release, Snap-on® introduces its Secure Vehicle Gateway™ solution to unlock 2018 and newer FIAT Chrysler Automobiles for direct access from the scan tool to the vehicle's secure gateway module. Technicians that have a Snap-on Wi-Fi enabled diagnostic platform, with the most current software, now have the ability to perform reset functions and bi-directional tests that were previously inaccessible because of the secure vehicle gateway.

In order to connect, technicians need:

- A compatible diagnostic platform.
- An authorized OEM account.
- A Snap-on profile to manage everything in one place — technicians simply store their compatible diagnostic tool details and OEM account information in a centralized Snap-on profile and they're ready to connect quickly, easily and securely.

The added layer of security on secure gateway vehicles means that there is an additional authentication step between connecting and communicating with the vehicle using a diagnostic tool. If that authentication is not complete, then technicians would be able to see codes, but they couldn't clear codes or perform any bi-directional tests. For example, if they needed to recalibrate the front radar on a Jeep Grand Cherokee due to a front end collision, they wouldn't be able to without unlocking the SGW module. Or if a blend door goes bad that they replace, they'll need to perform a blend door actuator recalibration, but they will not be able to complete all of the repairs without the ability to unlock the SGW module.

All FCA secure gateway compliant solutions require a device and user registration. The Snap-on solution is designed to help navigate through this process.

Snap-on has developed a website that walks users through the process step-by-step to set up an account. This can be found at www.snapon.com/gateway.

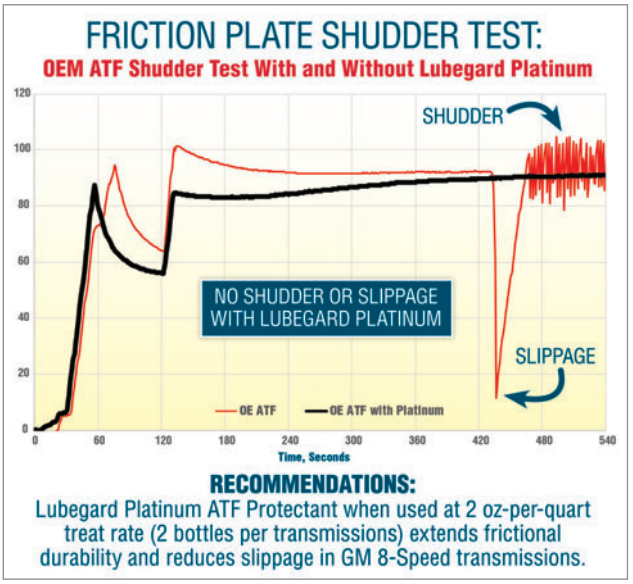
Lubegard Platinum ATF Protectant significantly reduces torque converter clutch shudder and slippage.

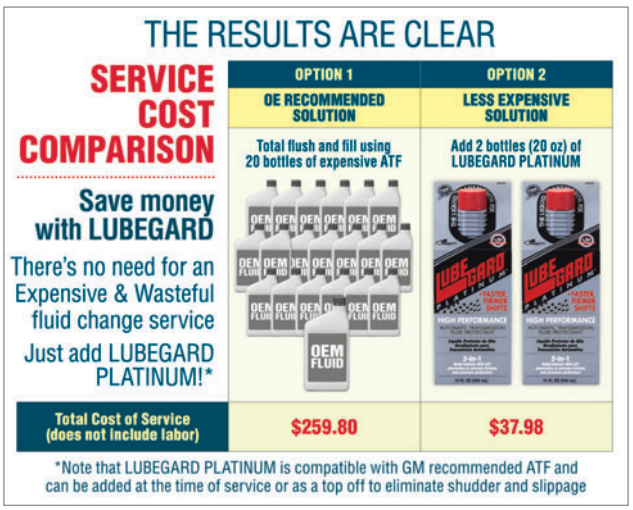
General Motors has issued several technical service bulletins pertaining to torque converter clutch shudder issues in two of their 8-Speed transmissions; 8L45 & the 8L90. This problem currently affects 11 different models across 3 different OEM manufacturers between the model years 2015 and 2019. GM's solution to this problem is lengthy & complicated, requiring 20 liters of ATF be flushed through the system to replace as much fluid as possible, yet still has not corrected the issue in some cases. With these vehicles approaching the end of their limited powertrain warranties, you can expect to see an increase of these vehicles in your shop.

We're here today to offer you a better, less complicated, and less expensive way to service these transmissions successfully with fewer comebacks and customer complaints.

We used our state-of-the-art Falex Multispecimen testing platform to develop conditions that caused shudder to occur between an automatic transmission friction plate and steel plate when lubricated with GM's recommended ATF specified in their technical service bulletins. We then eliminated the shudder under the same conditions by adding **Lubegard Platinum High-Performance ATF Protectant** to the test ATF at the treat rate of 2 fluid ounces per quart. An added advantage of the **Lubegard Platinum High- Performance ATF Protectant** was control and stabilization of the friction at a constant level throughout the tests.

When your customer is suffering from TCC shudder and/or slippage, you can help them avoid the expensive replacement of their OEM ATF by simply adding 2 bottles of Lubegard Platinum ATF Protectant, or, if the customer insists on replacement, you can avoid recurrence of the TCC shudder with the addition of 2 fluid ounces per quart of **Lubegard Platinum High-Performance ATF Protectant.**





LUBEGARD®

PURE ENERGY TURBOS

Powered by over 50 years of MPA innovation, technology, and legendary quality, Pure Energy is the only choice when it comes to turbochargers. Installation ready right out of the box, each Pure Energy turbo comes with all necessary gaskets, hardware, and lubricants to do the job right the first time. Motorcar Parts of America is YOUR SOURCE for turbochargers.

WWW.PUREENERGYTURBOS.COM

TECHNICAL TRAINING

WORLDPAC Training Institute (WTI) offers carline-specific advanced technical training, business management solutions and exclusive Smart Groups designed explicitly for independent repair shop professionals. Always developed and taught by experienced instructors, WTI training keeps you ahead of the learning curve to ensure your business remains competitive and profitable. View the complete class listing at the below website.

WWW.WORLDPAC.COM/TRAINING

BRAKE DISCS

Textar engineers have utilized the knowhow that comes from decades of producing premium OE brake pads to develop a perfectly matched brake disc that ensures the ultimate braking performance of your vehicle. The Textar range of brake discs is manufactured to precise German specification and are application engineered for cars driven in North America. Textar brake discs, Textar brake fluids (DOT 3, 4, 5.1), Textar anti-squeal pastes and Textar brake tools are available exclusively at WORLDPAC, as well as a full range of premier Textar brake pads, e-pads and brake shoes.

WWW.TEXTAR-WORLDPAC.COM

PLATINUM PAINTED ROTORS

Carquest Platinum Painted Rotors, an exclusive line of premium rotors offered by Advance Professional and Carquest, are designed to meet professional repair facilities' need for a high-performing rotor product that is visually appealing to today's drivers. Engineered with a rust inhibiting barrier that provides more protection than non-painted rotors, Carquest Platinum Painted Rotors help decrease brake noise and increase the life of a vehicle's brake pads. For more information on quality Carquest products, call your local Advance Auto Parts or Carquest delivery location.

WWW.CARQUEST.COM

AD INDEX

AD INDEX

PRODUCTS

TRAINING

HOW TO KEEP THAT TURBO SPINNING!

TURBOS ARE USED ON AN INCREASING NUMBER OF VEHICLES, BOTH DIESEL AND GAS. HERE'S HOW TO HELP THEM ENJOY A LONG AND HEALTHY LIFE!

PETE MEIER // Technical Editor

According the latest statistics I could find (2017), nearly 30 percent of all new vehicles sold in the U.S. were equipped with turbocharged, small displacement engines. And that number is rising!

For those of us with limited turbo experience, that brings new issues to the shop that we need to address. Turbochargers operate at extremely high speeds (ranging from 80,000 to 200,000 rpm), generating high heat loads internally on top of the heat exposure brought on by the hot exhaust gasses used to spin the turbine. That heat load must be controlled, typically by supplying the turbo with a steady supply of clean, cool lubricating oil.

Turbos also have extremely tight clearances internally — clearances that are not very tolerant of foreign objects trying to work their way in. Lack of maintenance or choosing a cheap oil filter can add to the amount of debris floating around in the oil, adding to the risk of premature turbo failure.

And that's not the only way debris can enter. Air filtration and maintaining the seal of the air passages is critical to keeping dirt out of the turbo and the engine. Ever hear the phrase "dusting a diesel?" Many of the same problems can infect gas models as well. No matter the fuel, engines as a whole are not happy when dirt gets in between critical components.

In this edition of The Trainer, we'll take a look at how you can inspect for conditions that could spell imminent death for your customer's turbo-equipped ride. After all, replacing a dirty filter or changing the oil more often is a much better option to replacing a failed turbo. But if you do have to replace a failed unit, we'll also offer some tips on ensuring that new replacement gets off to a good start.

O'Reilly FIRST CALL
DEDICATED TO THE PROFESSIONAL

A COMPLETE LINE OF

TPMS SENSORS & SERVICING EQUIPMENT

Let Us Be Your Parts & Equipment Supplier

www.oreillyauto.com/professional-catalogs

OTC

OBD-II TPMS TOOL

The 3838 OBD-II TPMS tool is both a sensor activation and diagnostic device. It couples On-Board Diagnostic (OBD) II relearn capabilities in one compact and portable housing. The 3838 features an exclusive wireless OBD-II module for TPMS sensor registration and works with all OEM and aftermarket sensors.

- Large 3.5" color display featuring easy-to-read icons
- Exclusive wireless OBD-II module to initiate and perform relearn procedures
- SD card for vehicle history storage
- USB for software updates
- RJ45 connection capability

OTC 3838

90% COVERAGE
WITH JUST FIVE PART NUMBERS

VDO REDI-Sensor™

MULTIPLE APPLICATION TIRE PRESSURE MONITORING SYSTEM (TPMS) SENSORS

- Pre-programmed and designed to follow OE vehicle relearn procedures
- No sensor programming required
- Consolidates vehicle protocols from a large number of OE sensors
- Provides over 90% coverage of vehicles in North America with five part numbers
- Works with all major TPMS scan tools
- Reduces inventory and eliminates service delays
- OE designed and validated
- Replaces all sensor styles: clamp-in, snap-in and banded

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 1479