

# Motor Age

Advancing the Automotive Service Professional Since 1899

April 2014

Talk Shop Anytime



AUTOPRO WORKSHOP

Vol. 133, No. 4

## COMMUNITY

### MOTOSKILL TESTS FOR SUCCESS

MotoSKILL Shop Tech Training offers a "Pass or Don't Pay Guarantee" for ASE test takers

## PRODUCTS

### WORK SMARTER, NOT HARDER

We round up the tools you need to optimize your shop

## OPERATIONS

### SELL A/C SERVICE OUT OF SEASON

Yes, *now* - not when it's hot out



# KEEP THE 'COOL' IN COOLING SYSTEMS

RETHINKING THE 80/20 RULE

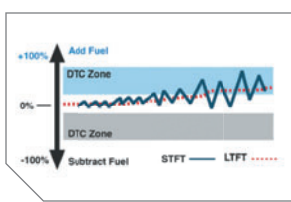
ADVANSTAR AUTO

**TRENDING**  
**ASA GROWS PROGRAMS**  
NACE/CARS shows expand footprint



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**TECHNOLOGY**  
**WHAT IS FUEL CONTROL?**  
Learn the art and science of optimum fuel delivery

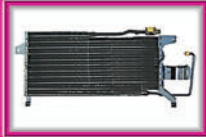




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PANASONIC  
14-0162NEW \$234.00



GM TRUCK  
1996-00 C AND S  
HT6  
14-20151NEW \$130.00



FORD  
08-09 ESCAPE  
DKS17DS  
14-0324NC \$258.00



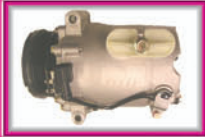
MINI COOPER  
2002-06 1.6L  
CVC  
14-0251NEW \$169.00



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14-0286NEW \$130.00



SUBARU  
2000-03 OUTBACK  
DKV14G  
14-0057NEW \$247.00



HONDA  
2002-05 CIVIC  
TRA090  
14-0023NEW \$117.00



GM CARS  
1996-2005  
V5  
14-20541NEW \$130.00



TOYOTA  
1999-08 VARIOUS  
EXPANSION BLOCK  
18-0042 \$15.00

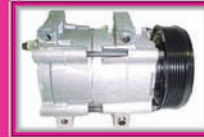


ACURA  
04-08 TSX  
HS110 3 WIRE  
14-0331NEW \$130.00



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ACCUMULATOR  
17-2924 \$16.50



SUBARU  
2004-07 IMPREZA  
CR14  
14-0118NEW \$234.00



TOYOTA  
05-09 TACOMA  
ALL W/ DELPHI SP15  
14-0253NEW \$169.00

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FORD TRUCK  
2006-2012 F150  
HS-20  
14-3552NEW \$130.00



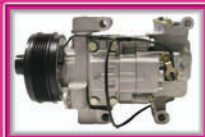
EVAPORATOR  
UNDERDASH  
UNIVERSAL 12V  
30-0120 \$89.00



VOLKSWAGEN  
7D7V16 14-4023NEW  
14-2827 & 14-2828NEW  
14-3659NEW \$156.00



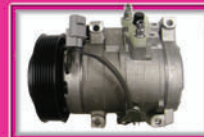
AUDI  
07-08 S8  
7SEU16C  
14-0187NC \$338.00



MAZDA  
2006-09 MAZDA 3  
PANASONIC  
14-0639NEW \$234.00



HONDA  
2002-06 CR-V  
HS110R  
14-0092NEW \$130.00



TOYOTA  
00-07 HIGHLANDER 2.4L  
10S17C  
14-4030NEW \$151.00



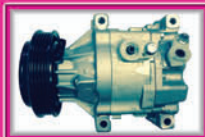
JEEP GRAND CHEROKEE  
1995-98 W/O ATC  
PF EVAPORATOR  
59-4002 \$50.00



HONDA  
2003-07 ACCORD  
10S17C  
14-0155NEW \$156.00



HONDA  
1999-2004 ODYSSEY  
10S10C  
14-0071NEW \$156.00



TOYOTA  
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SCS06C  
14-0068NEW \$156.00



CHRYSLER  
2001-05 PT CRUISER  
10S15C  
14-5044NEW \$130.00



JEEP  
07-09 WRANGLER  
DKS17D  
14-0307NC \$258.00

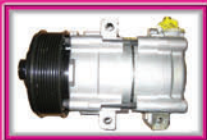


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CHEVROLET  
1999-2010 PICKUP  
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FS10  
14-3028NEW \$115.00



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SCROLL  
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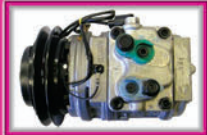
HONDA  
2006-11 CIVIC  
TRSE07  
14-0250NEW \$130.00



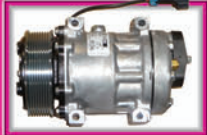
TOYOTA  
2004-06 SIENNA 3.3L  
10S20C  
14-0135NEW \$156.00



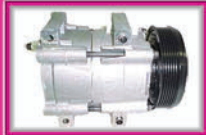
CHRYSLER  
2001-07 CARAVAN  
10S20H  
14-0040NEW \$130.00



KIA  
1982-2007 SPORTAGE 1GV  
10PA15C  
14-2820NEW \$130.00



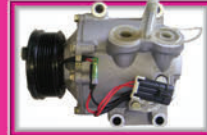
FREIGHTLINER  
SANDEN 4417  
W/ 8 GROOVE CLUTCH  
14-SD4417NC \$182.00



FORD  
1992-01 RANGER  
1990-97 F SERIES  
14-2735NEW \$115.00



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HS090R  
14-0122NEW \$130.00



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ISUZU  
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DKV14G  
14-0053NC \$258.00



FREIGHTLINER  
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W/ 8 GROOVE CLUTCH  
14-0729NEW \$208.00



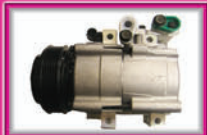
NISSAN  
2000 PATHFINDER  
CWV618  
14-4016NEW \$143.00



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6 GROOVE R4  
14-20189F \$151.00



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3 CFM  
52-1849 \$138.00



KIA  
02-05 SEDONA  
FS10  
14-7002NC \$156.00



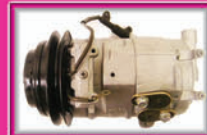
MERCEDES, CHRYSLER  
SPRINTER, CROSSFIRE  
7SB16C  
14-2986NEW \$156.00



MAZDA  
02-03 PROTEGE 5 2.0L  
B26K-61-450D  
14-0110NC \$258.00



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HS-18  
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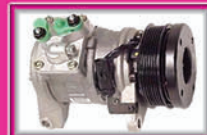
HONDA  
2003-07 ACCORD  
10S17  
14-0164NEW \$156.00



CHEVROLET  
2006-11 IMPALA  
CVC SMALL BODY  
14-21471NC \$208.00



CAVALIER  
2002-2004  
CVC  
14-21198 \$195.00



DODGE  
1996-99 CARAVAN  
10PA17J DENSO-0104  
14-2896NEW \$130.00



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43-MT0399 \$64.50



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10S17C  
14-0043NEW \$156.00



VOLVO  
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DKS15D  
14-0303NC \$258.00



GM TRUCK  
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10S17F  
14-21177NIP \$195.00



NISSAN  
99-01 MAXIMA  
CWV618  
14-0078NEW \$156.00



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10PA17E  
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TOYOTA  
01-07 SEQUOIA 4.7L  
10S20  
14-0081NEW \$156.00



HONDA  
1994-2001 CIVIC  
TRS 090  
14-3555NEW \$150.00



NISSAN  
2002-06 ALTIMA  
DKS17D  
14-0142NEW \$210.00



MAZDA  
2007-09 MAZDA 3  
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14-0638NEW \$297.00



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## COMMUNITY

### 14 MotoSKILL tests for success

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plus **Stats & Trends**  
*Noteworthy*

FROM THE  
**BLOG SPHERE**

**BEST OF THE BLOGS**

**TOP VIDEOS CALENDAR**



Q+A WITH

**16 Rich White,**  
Senior VP of  
the Auto Care Assn.

April is National Car Care Month, and there are many ways to celebrate.

### 120 The Trainer The heart of the matter

The A/C compressor is the heart of the air conditioning system. Take care of it, and it will last a lifetime.

## ONLINE COVERAGE

**MotorAge**  
TRAINING

Self-Study Guides for ASE Certification

### Upcoming Webinars & Archives

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[MotorAge.com/video](http://MotorAge.com/video)



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Keep air conditioning components in top shape so as not to stress the compressor.

[MotorAge.com/apr14trainer](http://MotorAge.com/apr14trainer)



### HYBRID REPAIR

[/hybridrepair](http://hybridrepair)



### SCAN TOOL TIPS

[/scantips](http://scantips)

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## EDITORIAL STAFF

Group Content Director

Michael Willins

[mwillins@advanstar.com](mailto:mwillins@advanstar.com)

(440) 891-2604

Managing Editor

Tschanen Brandyberry

[tbrandyberry@advanstar.com](mailto:tbrandyberry@advanstar.com)

(440) 891-2745

Technical Editor

Pete Meier ASE

[pmeier@advanstar.com](mailto:pmeier@advanstar.com)

Art Director

Steph Bentz

Senior Designer

Stalin Annadurai

Contributing Editors

Vanessa Attwell

Brian Canning

Mark DeKoster

Chris Frederick

Bill Haas

Dave Hobbs

Tim Janello

John D. Kelly

Dave Macholz

Richard McCuistian

Mike Miller

Albin Moore

Mark Quarto

G. Jerry Truglia

Editorial Director, ASE Study Guides

James Hwang

[jhwang@advanstar.com](mailto:jhwang@advanstar.com)

(714) 513-8473

SUBSCRIPTION CHANGES/  
CUSTOMER SERVICE

(888) 527-7008

(218) 740-6395

BUSINESS STAFF

Vice President/General Manager

Jim Savas

Group Publisher

Terri McMenamin

[tmcmnamin@advanstar.com](mailto:tmcmnamin@advanstar.com)

(610) 397-1667

Business Manager

Nancy Grammatico

Administrative Coordinator

Gladys Hart

Sr. Production Manager

Karen Lenzen

(218) 740-6371

Circulation Director

Anne Brugman

Circulation Manager

Tracy White

(218) 740-6540

Marketing Director

Boris Chernin

[bchernin@advanstar.com](mailto:bchernin@advanstar.com)

(310) 857-7632

Web Marketing & Strategy Manager

Bala Vishal

[bvishal@advanstar.com](mailto:bvishal@advanstar.com)

(310)-857-7659

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AUTO

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- ▶ 5R110W updates and changes
- ▶ Power window troubleshooting
- ▶ Delphi diagnostics

## TECHNOLOGY



### ELECTRICAL

## HYBRID A/C SERVICE

BY **DAVE MACHOLZ** | CONTRIBUTING EDITOR

**66** Hybrid air conditioning systems present some unique challenges. Is your shop equipped to handle them?

### UNDERHOOD

## KEEP THE 'COOL' IN COOLING SYSTEMS

BY **DAVE HOBBS** | CONTRIBUTING EDITOR

**76** Cooling system service fundamentals are unchanging, but the details — ah, the details.

### UNDERCAR

## THE NEW A/C CHALLENGES

BY **PETER F. MEIER** | TECHNICAL EDITOR

**86** The days of R134A are nearing an end. What challenges will that bring us?

### SCOPE & SCAN

## WHAT IS FUEL CONTROL?

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

**98** It's the right amount of fuel delivered at just the right time. It's also both an art and a science.

### MOTOR AGE GARAGE

## A DIAGNOSTIC 'CHOOSE YOUR OWN ADVENTURE'

BY **SHAUN O'NEILL** | CONTRIBUTING EDITOR

**100** A recently purchased VW gives the new owner a wild surge while using cruise control.



### DRIVABILITY

## JOURNEY TO NEW ORLEANS

BY **PETE MEIER** | TECHNICAL EDITOR

**44** Pete serves up insights and reflections on the 2014 MACS training event and trade show in the Crescent City.

### POWERTRAIN PRO COLUMN

## PARK PROBLEMS WITH DODGE RE TRANSMISSIONS

BY **WAYNE COLONNA** | POWERTRAIN PRO PUBLISHER

**32** A redesign in 2002 altered the geometry of the parking rod.



### ATSG TECHNICAL TRAINING

## IN-VEHICLE REPAIR

BY **WAYNE COLONNA** | POWERTRAIN PRO PUBLISHER

**54** Let's investigate a no-forward movement issue with the AS68RC transmission, and how to do a common ring repair on a RE5R05A transmission.

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### SALES STAFF

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

**Eastern/Southern States**  
Paul A. Ropski, Regional Sales Manager  
Tel: (312) 566-9885  
Fax: (312) 566-9884  
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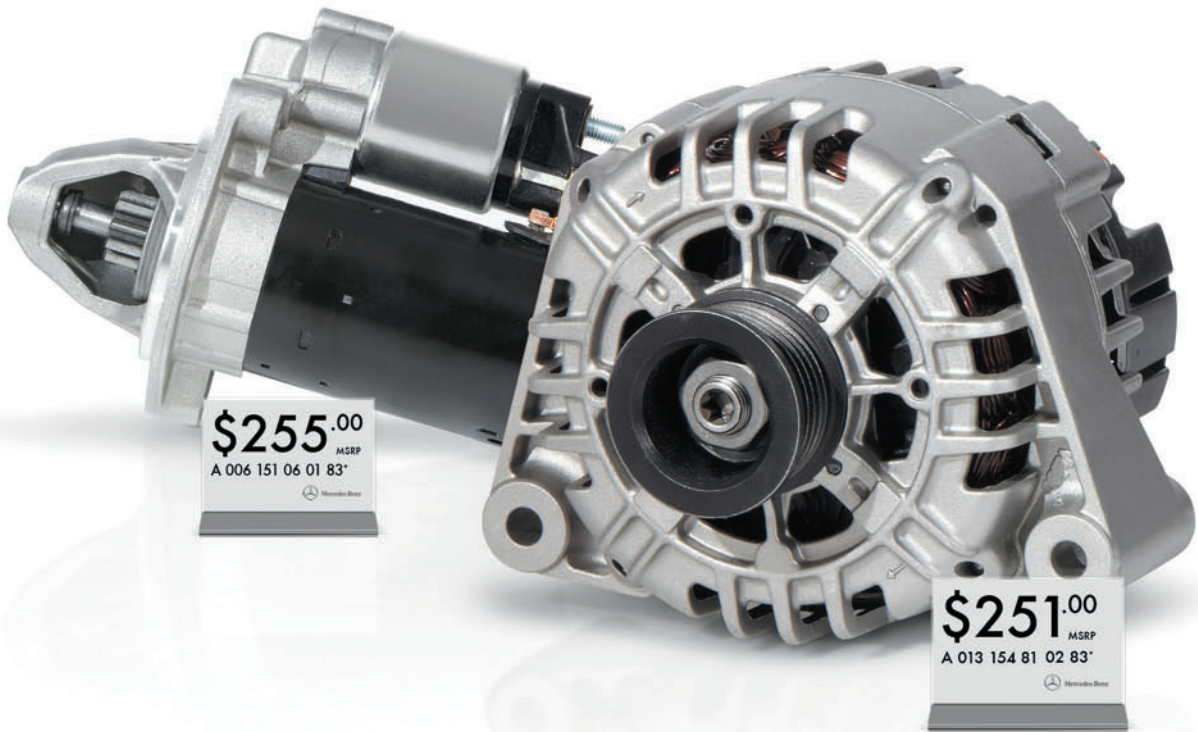
**Ohio/Michigan/Southern California**  
Lisa Mend, Regional Sales Manager  
Tel: (773) 866-1514  
Fax: (773) 866-1314  
lmend@advanstar.com

**Inside Sales/Classified Sales/Recruitment**  
Keith Havemann, Sales Representative  
Tel: (310) 857-7634  
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**List Rental Sales**  
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csimmerman@advanstar.com  
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OPERATIONS



MANAGEMENT

**SELL A/C SERVICE OUT OF SEASON**

BY BRIAN GANNING | CONTRIBUTOR

**18** Yes, now — not when it's hot out — is the time to start talking cool with your customers.

PROFIT MATTERS

**BREAKING THE RULES**

BY CHRIS "CHUBBY" FREDERICK | CONTRIBUTOR

**22** What's the difference between the 80/20 rule and the 20/80 rule, and why should we care?

FINANCIAL FIGURES

**THE NEW FORMULA FOR CULTURE**

BY BOB GREENWOOD | CONTRIBUTOR

**24** As you prepare to move forward, it's time to develop and measure the new shop culture required in today's aftermarket.

SHOP PROFILE

**YOU ARE WHAT YOU MARKET**

BY ROBERT BRAVENDER | CONTRIBUTOR

**26** Just because the shop is outside of Detroit doesn't mean it's experienced a similar economic fate.

TRENDING



8

**NACE/CARS FOOTPRINT GROWS WITH EXPO**

**8** ASA continues to push for industry unification by expanding its overall program offerings during the 2014 NACE/CARS shows in Detroit this summer.

**TRANSTAR INDUSTRIES ACQUIRES ETX**

**8** ETX owns DACCO, Alma Products and ATCO Products.

**TFI ENVISION 'KEEP YOUR ENGINE NAPA HAPPY' CAMPAIGN**

**12** The new campaign addresses that "sinking feeling" drivers get when their Check Engine light comes on without warning or explanation.

**MITCHELL 1 TO HOST SHOP MANAGEMENT WORKSHOP**

**12** The workshop is set for May 1-3 at the Resorts Casino Hotel in Atlantic City, N.J.

PRODUCTS

**INTERCOOLER LINE**

**111** CSF debuts a line of OE-style tube-and-fin and heavy-duty plate-and-bar type intercoolers.

Tire changer



111

**112** Gear sets



**APG** Voice of the industry



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### PLUGGING INTO THE TELEMATICS OPPORTUNITY

Insurance companies and OEMs are expanding their telematics deployments.

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### RESELLERS LOOK TO IMPROVE UPON A GOOD YEAR

Resellers had a good year in 2013 and most expect to do even better in 2014, according to the *Aftermarket Business World* reseller product study.

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An integrated gear shift in the wheel is one of many innovations.

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### BARTEC RELEASES TOOL SOFTWARE UPDATE 51

The company added three new sensors to its TPMS tool line.

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### BOSCH ADDS 44 PART NUMBERS TO 3 LINES

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Matthew Godlewski, vice president of the Alliance of Automobile Manufacturers.

## LIVE FROM VISION

# NACE/CARS footprint grows with expo

The Automotive Service Association (ASA) continues to push for industry unification by expanding its footprint and overall program offerings during the 2014 NACE/CARS shows in Detroit this summer.

During a press conference March 7 at ASA-Midwest's Vision Hi-Tech Training and Expo in Overland Park, Kan., ASA and the Alliance of Automobile Manufacturers announced plans for the OEM Technology & Innovation Expo, featuring new technologies being launched by carmakers. The Expo is scheduled for Friday, Aug. 1, and will include panel discussions with OEM experts, and product and application demonstrations.

The Alliance is an association of 12 vehicle manufacturers including BMW Group, Chrysler Group, Ford Motor Co., General Motors Co., Jaguar Land Rover, Mazda, Mercedes-Benz USA, Mitsubishi Motors, Porsche, Toyota, Volkswagen Group of America and Volvo Cars North America.

Matthew Godlewski, vice president of the Alliance, says his members are excited to see NACE/CARS coming to Michigan "the heart of the auto industry."

"A host of technologies will be on display," said Godlewski. "OEM experts in the field will be on hand, including a panel discussion regarding telematics and future innovation in diagnostics and repair."

Firm details on the event have not been determined,

**[NACE/CARS expands]** CONTINUES / PAGE 10

## BREAKING NEWS

### ACQUISITIONS

# TRANSTAR INDUSTRIES ACQUIRES ETX, HOLDING COMPANY OF DACCO

In March, Transtar Industries, Inc., owner of automotive aftermarket brands including Transtar, Transtar Autobody Technologies, King-O-Matic, Axiom and Nickels Performance, announced it has acquired ETX, Inc. from Chicago-based privately held Jordan Industries and private equity firm The Edgewater Funds. ETX owns DACCO, Inc., a Cookeville, Tenn. supplier of aftermarket transmission replacement parts, torque converters and complete transmissions; Alma Products, an Alma, Mich. manufacturer of torque converters and air conditioning compressors; and ATCO Products, Inc., a Ferris, Texas manufacturer of OE air conditioning, cooling and power steering assemblies and components. Terms of the sale were not disclosed.

"This acquisition brings together the DACCO and Transtar brands in a historic partnership that will create unsurpassed customer value and an even stronger future for both our companies," says Tim Bowes, president and CEO of Transtar Industries. "DACCO's employees have built significant customer

**[Transtar]** CONTINUES / PAGE 10

Discussion is on-going in [MotorAge.com](http://MotorAge.com) forums





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 **KNOW HOW**

**[Transtar]**

CONTINUED FROM PAGE 8

and distributor relationships in this industry, and their reputation is built on an impressive legacy of service, technical expertise and company-wide best practices. Alma and ATCO are a strategic complement that expands our overall automotive portfolio in the OE and after-market channels, along with Transtar Autobody Technologies, our existing

paint, body and equipment business.”

“We are extremely pleased to become part of Transtar Industries, and look forward to continuing to serve our customers in the automotive industry,” says Alan Gatlin, president and CEO of ETX. Alma and its 250+ employees have supplied Ford, John Deere, CNH and many other customers with air conditioning compressors, torque converters, clutch and disc assemblies, and transmissions for over 70 years. ATCO and its 200+ employees have supplied Ford, Paccar/

Dynacraft, Navistar and other customers with air conditioning, cooling and power steering assemblies and components since 1967. Gatlin will lead the Alma and ATCO businesses as president and general manager, and will report to Bowes.

“Transtar shares our core values around integrity, respect, responsibility and pride,” says Harry Schmink, president and general manager of DACCO. “It is exciting to join forces with their team, who demonstrate the same focus on customer service that our DACCO employees deliver every day. Together, our service, product expertise and our unrivalled range of high-quality transmission parts and repair solutions will be a win for our customers.” In business since 1968, DACCO has 47 stores in 24 states, and 500+ employees in sales and manufacturing. Schmink will lead domestic sales and marketing for Transtar as VP of sales and marketing, and will report to Bowes.

With this acquisition, Transtar Industries grows to approximately 2,300 employees and over 130 locations throughout North America. “This acquisition will let us leverage the power of our combined businesses to enhance our capability as the complete aftermarket transmission solutions provider, and also expand into OE product offerings,” Bowes concludes.

**[NACE/CARS expands ]**

CONTINUED FROM PAGE 8

but ASA Executive Director Dan Risley said the idea is to feature coming technologies that shops (both collision and mechanical) will need to understand in order to properly fix vehicles.

“Automotive repairers will have a chance to hear about the latest OEM technologies and what we may see in the future as far as vehicle technology,” said Risley. “Our ASA leadership has discussed the importance of more information and education on telematics and other top technology issues for some time. The OEM Technology & Innovation Expo is now a reality for our Detroit show.”

Along with the EXPO, the week of July 28 will tie together various industry activities at Detroit's Cobo Center. Included among the week's events are the Collision Industry Conference (CIC), I-CAR Conference, NACE/CARS and the MSO Symposium.

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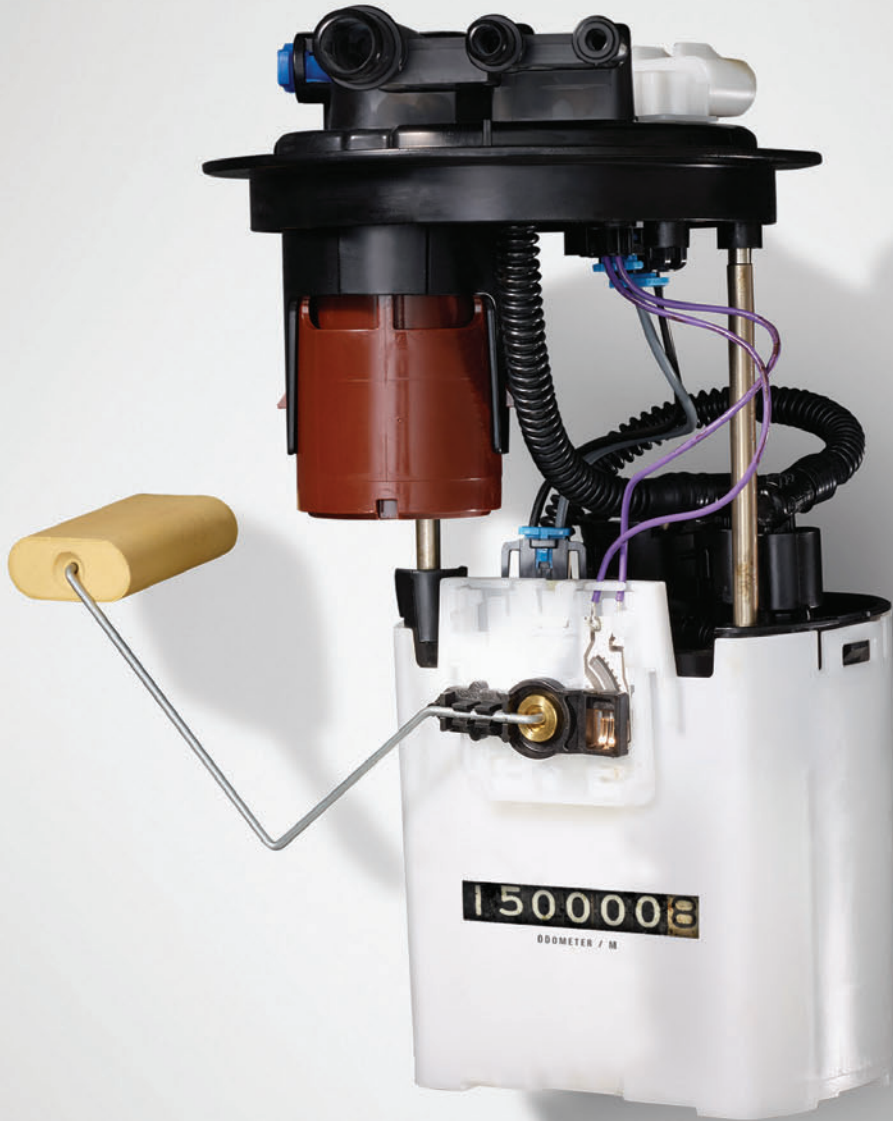


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## TFI Envision 'Keep Your Engine NAPA Happy' campaign

Standard Motor Products, Inc. selected TFI Envision, Inc. to design and develop a consumer education program for NAPA® (National Automotive Parts Association) to specifically address that "sinking feeling" drivers get when their Check Engine light comes

on without warning or explanation. They took the tactic of changing the meaning of the light.

TFI Envision developed the "Keep Your Engine NAPA Happy" campaign idea and logo, transforming that scary "Check Engine" light into a positive reminder that NAPA Auto Parts Store can help drivers take care of their car and keep their engines happy.

The program includes oversized window cling posters that are clearly visible



when driving by the NAPA Auto stores as well as counter mats and counter cards.



## Mitchell 1 to host shop management workshop

Mitchell 1 will hold this year's first Shop Management Workshop, May 1-3 in Atlantic City, N.J. at the Resorts Casino Hotel, located at 1133 Boardwalk. The training is designed for those who have previously established competence using their shop management software and now want to learn more advanced capabilities, better methods, shortcuts and new features.

The two-day training session guides users through all levels of functionality in Mitchell 1 and ShopKey Manager SE 6.5 and legacy systems, including 5.9. Topics include program setup values, inventory, reporting, best practices and advanced transactions as well as integration with aftermarket cataloging. Attendees will also learn about the Mitchell 1 SocialCRM™ customer retention and new customer acquisition service during a relaxed evening reception.

The workshop will be led by John Dwulet, senior product manager for Mitchell 1's management software solutions, and Tim McDonnell, national training manager, who together have over 35 years of combined shop management system training experience. Attendees can expect lively discussions on how to use the management system to energize their business, increase profits and boost productivity.

Attendees can earn 30 AMI credits toward the Accredited Automotive Manager (AAM) designation by completing the workshop. Visit <http://buymitchell1.com/form/m1usersinfo.htm> to register and to learn more.

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## ASE GUIDES

### QUESTION OF THE MONTH



SPONSORED BY **Federated Auto Parts**

✓ **SURVEY:** April marks our annual air conditioning/cooling system service issue. If you've been paying attention to the news on the new refrigerants, this ASE Question of the Month should be easy! All of the following are potential candidates to replace R134a in automotive air conditioning systems EXCEPT:

- A. R744
- B. R1234yf
- C. R22
- D. R445a

Answer the question at [MotorAge.com/apr14survey](http://MotorAge.com/apr14survey) and enter our monthly contest from Federated Auto Parts.



## MotoSKILL ASE training offers test prep guarantee

BY GREG MILLER | WRITER

**M**otoSKILL™ Shop Tech Training, a comprehensive training program with more than 180 hours of online video courses for automotive technicians and service writers, is now offering a "Pass or Don't Pay Guarantee" for ASE test takers. Participants who successfully complete the MotoSKILL ASE Test Prep Training Bundle or any single ASE test prep course qualify for a money-back guarantee from MotoSKILL in the event they do not receive a passing ASE exam score.

MotoSKILL is available from MOTOSHOP™ Technology Tools, a product portfolio from Advance Auto Parts, Inc.

Training courses from MotoSKILL are web-based, allowing users to access content at any time, from any location. The ASE Test Prep Training Bundle includes study guides, interactive practice quizzes, test tips, and more than 40 hours of video content delivered by industry instructors.

In addition to ASE test preparation, MotoSKILL offers a selection of courses from automotive basics to advanced diagnostic training. Users may choose individual courses

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

### Are smartphones outsmarting you?

By Charles Taylor

People searching on mobile phones are searching with intent meaning they are making a buying decision. This is how mobile devices have shaped internet searches. People are using their smart phones to get actionable information — getting directions to a restaurant, or if you need to contact a company right now, like when your car breaks down. This is why it is important for your company to be there when that searcher is looking for you: So you get the call and not your competitor.

When you are "surfing the web" or browsing, you're generally doing research or looking into an interest you might have. Usually when doing this, you're not making a decision in the next few seconds. This is common to do on a desktop, laptop or tablet. This is why smart phones

are such a hot thing: Because people searching on their phones to buy services they need immediately.

Looking back, this type of search is similar to how people used the *Yellow Pages*. You did not aimlessly pick up the phone book to browse through the ads and listing for hours. You picked up the the *Yellow Pages* because you needed a service at that very moment, and you made that phone call to buy.

This is why it is so important that our clients are right in front of that mobile searcher, because we know that person is going to make a buying decision.

Getting on the first page is hard; looking like the best choice on that first page is even harder. So let's say your shop is on the first page and you have the most reviews. But your website is not set up for mobile devices. You could lose that

potential customer who is looking to buy your services."

### Gas & oil boom

By Gary McCoy

I recently interviewed Dr. Nariman Behraves, chief economist of IHS and author of "Spin-Free Economics: A No-Nonsense, Nonpartisan Guide to Today's Global Economic Debates." Behraves provided an economic update to the 2014 Spring Manufacturers Institute (SMI) annual meeting. He provided an overall forecast that 2014 would experience overall growth when compared to 2013. Behraves predicts that inflation and interest rates will remain low for at least another year. He says the unconventional energy boom that is going on in the U.S. will continue to help strengthen the economy.



May 22, 6 p.m. EST

## A/C Servicing Best Practices

We'll speak with air personnel at MacDill Air Force Base and recap the latest news affecting the a/c service field.



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## AUTOMOTIVE SERVICE ASSOCIATION

NACE/CARS

ASA expands program offerings

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## Q+A WITH RICH WHITE

AUTO CARE ASSOCIATION

Celebrate Car Care Month

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## THE TRAINER VIDEO

PETE MEIER

Care & feeding of the A/C compressor

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### VISION 2014: Trade Show Highlights

Over 60,000 square feet of floor space was used to showcase exhibits from a variety of vendors at this year's Vision Hi-Tech Training and Expo held in the Overland Park Convention Center.

[MotorAge.com/VISION\\_2014](http://MotorAge.com/VISION_2014)

### VISION 2014: A Personal Report

This year was a special year for *Motor Age* at Vision. We held not one, but two, live presentations on site that were also streamed live to our online viewers.

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MAY 22

### EPA 609 Certification

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JUNE

### Using Scopes

This webinar will be brought to you in cooperation with ATSG.

JULY 10

### Documentation Best Practices for Key-to-Key and Digital Photography

This webinar will be brought to you in cooperation with I-CAR.



STREAMING PROGRAMS

AAIA rebrands

### to Auto Care Association

We talk with representatives about starting this new chapter in the association's history, which officially begins April 24. /NewACA

### Social Media

Tips and tricks to optimizing social media for their business, as well as some understanding of tools like Twitter and Facebook. /Jan14Social

### Blue Link Diagnostics: Programming Mercedes Transmissions

This webinar covers the three different types of programming required depending on the work performed. /BlueLink



Noteworthy

comments from *MotorAge's* online communities

The best of what you're saying on [Facebook.com/MotorAgeMagazine](http://Facebook.com/MotorAgeMagazine), [@Motor\\_Age](http://Twitter) and [@PeteMeier](http://Twitter) and the AutoProNetwork

craigscarce:

You are right about it being harder to find the younger generation that will take the hunt to the full end game and play it correctly without trying to cheat, as opposed to the instant gratification group.

17tamx:

Isn't the biggest problem about CO2 as a refrigerant in a Mobil A/C system the fact that it will not blow cold enough when ambient temps are above 90 degrees? There are also

other problems as well but must we live in a moderate climate to be satisfied with the performance of CO2 as a refrigerant?

Marc Berger Jr via Facebook:

Caterpillar is using this stuff on their machines. The amount of crap they are putting on these engines is insane. It is problematic and inefficient when it comes to economy. Fortunately we don't really worry about fuel mileage like on road vehicles. The costs only end up coming from the

consumers' pockets in the forms of technology and repairs instead of fuel.

@LoviesCarRepair TWEETS:

@Motor\_Age thanks for the follow! I love the info & training you all bring in the open. Very useful stuff & always teaches new things

@racefanb TWEETS:

Congrats slugger. Awesome job this past weekend. RT @Motor\_Age: @SluggerLabbe wins @moogps in Las Vegas: <http://bit.ly/1eoorvB>



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2014 INDUSTRY CALENDAR

MAY 20-21

### Global Automotive Aftermarket Symposium

Chicago

JULY 30-AUG. 2

### NACE/CARS

Detroit

OCT. 10-12

### Northwood University's 51st Annual International Auto Show

Midland, Mich.

NOV. 12-15

### Automechanika Argentina 2014

Buenos Aires



# Q+A WITH RICH WHITE

SENIOR VICE PRESIDENT OF  
THE AUTO CARE ASSOCIATION



## APRIL IS CAR CARE MONTH. HOW ARE YOU USING THESE FOUR WEEKS OF AWARENESS TO BUILD YOUR BUSINESS?

BY BRUCE ADAMS | CONTRIBUTING EDITOR

**H**ow can companies promote and benefit from the annual celebration of April is Car Care Month? *Motor Age* recently sat down with Rich White, senior vice president of the Auto Care Association (which up until April 24 was known as the Automotive Aftermarket Industry Association, or AAIA) to find out.

**MA:** Let's discuss the value of Car Care Month and why it's in April.

**RW:** This is a great year to explain why April and why it is important, because if you look at the timing of April, it's spring-time, you're moving out of the ravages of winter, and almost the whole country has suffered this year. It's a great time to get the car back in shape, and repair, maintain it, from all that has happened over the winter. And also, it's right as you prepare for the spring and summer travel season. It's just always been a very good time, with the product promotions that go on for spring maintenance and upkeep and things that have to be done. It just makes sense. It's just a great time for people to forget about the cold weather and all that, and start thinking about summer vacation and getting the car in shape again. Now if they do that themselves, or if they go to a repair shop, they're not going to have any problems

this summer. And that's really why people come to the Car Care Council; they're looking for information about what they can do to their vehicle that's going to make it safer and more economical, less polluting and save them some money. Again, they come to us for that kind of information and advice.

For us, April is National Car Care Month is a time of stepped-up publicity. We really kind of ramp it up and send it out on all releases, media. The media is very aware of Car Care Month. And a lot of people in the industry are very involved and celebrating in their marketing and advertising programs: "Come in for a special on certain things or a free checkup. We're celebrating National Car Care Month!" So it's a nice time to celebrate — although as far as we're concerned, every month is Car Care Month.

**MA:** What are some of the things companies can do to celebrate with and engage their customers?

**RW:** It's a great opportunity to do two things. One is to reinforce the loyalty of your existing customers and keep them coming back. But it's also a good opportunity to market and try to attract new people... and the things you can do to help celebrate really run the gamut. You could do something as simple as say



"Hey, stop by and we'll do a five-point checkup for free." You could hang a banner over a bay. You could do a little online advertising, some social networking — send out emails to existing customers. Run some ads, give discounts. Or it could be as extensive as hosting a clinic, let's say a women's clinic in your shop: People come in and you host an educational session. Those are very popular.

Or there's the whole three-ring circus thing, where you partner with a store or group to have checkup events. Those could be where people bring their cars to a checkup event on a Saturday or Sunday in the parking lot of a shopping mall or church or school, and you have technicians and maybe even auto shop students, performing the checks on the vehicle. The consumer gets to talk to the technician, and ... it's a wonderful community event. **ZZ**



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## OPERATIONS

TAKE CONTROL  
OF YOUR BUSINESS

## IN THIS SECTION

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read it on **MotorAge.com**HOW TO KEEP  
EMPLOYEES  
HAPPY

Mike Lee goes over the basics — starting with goal-setting.  
/happyteam

EVENT  
MARKETING  
WORKS

Make the most of your face time with customers at events.  
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ASK THE RIGHT  
QUESTIONS

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/interview

## MANAGEMENT



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A/C

SERVICE  
OUT OF SEASON

YES, NOW — NOT WHEN IT'S HOT OUT — IS THE TIME TO START TALKING COOL WITH YOUR CUSTOMERS.

BY **BRIAN CANNING** | CONTRIBUTING EDITOR

**AS YOU** read this, my sincere hope is you have spent fall, winter and early spring talking to your technicians and customers about air conditioning service, and that as we move toward summer, your customers already have begun to address maintenance and repairs in this critical area — or are at least thinking about it. However, a much more likely scenario is that as soon as the temperatures cooled off in your market area last fall, you stopped thinking about A/C repairs and, because of that, so did your customers.

As hard as you might find it to believe, our customers come to us looking for recommendations, relying on us to keep their cars safe and reliable. That does not mean they always are happy to hear the things we have to say, and it certainly doesn't mean they will buy everything we recom-

mend. It does mean that we get them thinking about their A/C system before that first heat wave, when everyone from 10 miles around is in, clogging up our parking lot and begging us to make it blow cold.

I know it seems strange to even think about A/C repairs in cold temperatures, but by the same token, winter typically is not kind to us when it comes to car count or billed hours. Taking the time to check, service and repair A/C systems

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- \$1,959 Rent & Utilities
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NET INCOME	\$7,271	INCOME	\$21,263	EXPENSES	-\$13,992
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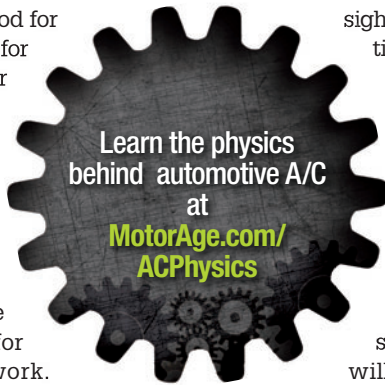
in the off-season is good for your technicians, good for your shop and good for your customers.

Air conditioning customers are a funny bunch. I have seen customers put off needed brake work and ignore engine performance issues in exchange for making their A/C work. There is no doubt that roasting in a hot car is a great motivator, and those July sales are pretty easy. But neglecting to check and make recommendations for services and repairs during the cooler months is missing out on selling opportunities that are sitting right there in your bay.

Maybe your shop is so successful and your technicians are pulling down so many hours that you just don't have the time to deal with A/C now, but most of the shops and shop owners I have dealt with over the years are starving for additional sales and billable hours. Again, you are not going to sell every service or repair you recommend, but you will sell some of them. The remaining customers, who have declined work, definitely will be thinking about those recommendations as the weather starts to warm up and summer is on the horizon.

Of course, your customers are not the first step in this process; that should be you sitting down with your service advisors and technicians and laying out your expectations. If you aren't looking, I can guarantee you are not going to find these additional A/C services and repairs you could be performing. If you don't let your people know that "we are trying something new this year," I can promise they won't be looking. I think it very likely that both your service advisors and technicians will look at you like you are crazy, looking for A/C work before it is hot outside. But these are the same guys who will complain that it's slow or that they aren't making enough money.

Conventional wisdom does not have us checking A/C systems in January and February, but conventional wisdom doesn't have to pay the bills or keep a staff of technicians gainfully employed either. Your follow-through and over-



sight of these new expectations are the only things that will move your shop in this new, and better direction. Your enthusiastic support and leadership will communicate your commitment to all of this.

Your celebrating their successes in this effort will allow them to step beyond their outdated perceptions — into a new approach that will see them generating more hours for you, and more wages for themselves.

### Check it out

Cars these days are marvels of design and technology, but like anything that is mechanical, they need maintenance and they occasionally need repairs. Things wear out. The funny thing about all of this is that they are wearing out all the time and need to be checked for wear, be serviced and even repaired regularly, even in the middle of winter. If you are waiting for summer to check your customer's A/C system, you are missing legitimate sales opportunities and doing your customers a disservice by not being thorough and complete in checking out their car when it is in your shop. Don't think that this misbehavior is the only one out there, because if you are like a lot of shops, you do nearly the same thing with cooling systems and batteries—you stop checking them the second it starts getting warm and don't get back to them until the first freeze next fall.

According to the Car Care Council, for both 2011 and 2012 there was in excess of \$50 billion in unperformed maintenance in the U.S. Yes, \$50 billion with a B. The problem is not consumers refusing to take care of their cars. The problem is that we, as an industry, are not doing a good job of checking out our customers' cars. We are not doing a good and consistent job at recommending and selling maintenance. That's because we, as an industry, are not committed to educating our customers on what it takes to keep their cars safe and reliable. If we are not educating our customers on maintenance and making service recommendations, I guarantee they are not going to think about it.

Even worse, if we are not consistent

in how we inspect the cars coming into our shop, including pending maintenance services, we have no chance of providing the excellent customer service our customers deserve. Maybe you would be comfortable with a doctor, a dentist or even a plumber who did an incomplete job, but I know I wouldn't. Our job as automotive repair professionals is to provide our customers with excellent customer service in our efforts to make their cars safe and reliable.

And since April is National Car Care Month, it's a great time to tie this all together.

### No time like the present

I know it's cold and dreary out there today, but when Mrs. Jones brings her car in later this morning for her regular oil change, what are you going to do? Do you think after 15 years of coming in as regular as clockwork to get her car serviced, she suddenly would be offended because we checked and her refrigerant was low? Do you think if we saw that her compressor wasn't kicking in, she would leave us?

I think that after all of these years coming to us, Mrs. Jones probably trusts us. I think she would probably want to hear what we have to say.

Two or three months from now, when your shop is clogged beyond moving, Mrs. Jones and a lot of your other longtime customers might be one of the customers sweating it out with no A/C, desperate to have you make it blow cold. She might be willing to wait three or four days until you can fit her in. But then again, she might not. Should you risk that?

The best time to sell those seasonal services is right now, no matter what the temperature is outside, no matter the season. **W**



**BRIAN  
CANNING**  
CONTRIBUTOR

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

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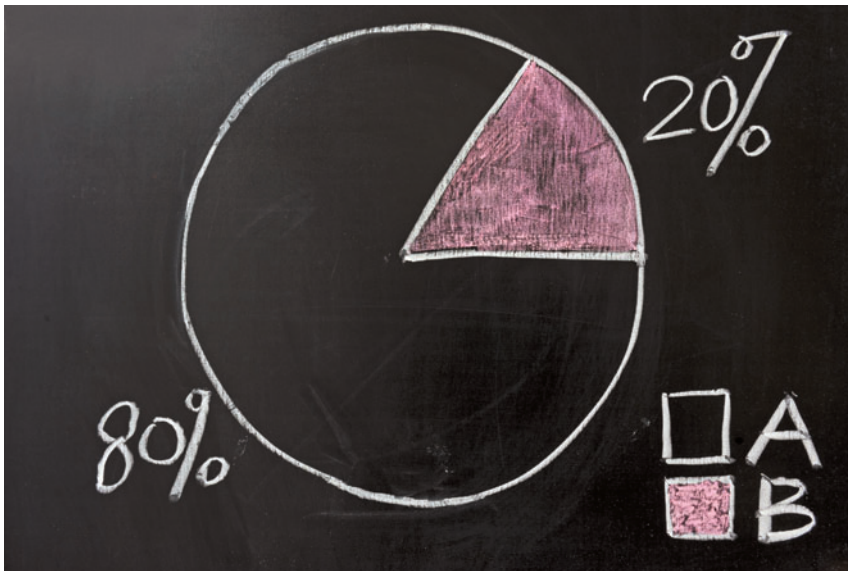
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# BREAKING THE RULES

WHAT'S THE DIFFERENCE BETWEEN THE 80/20 RULE AND THE 20/80 RULE, AND WHY SHOULD WE CARE?

BY CHRIS "CHUBBY" FREDERICK | CONTRIBUTOR



**IF I COULD** teach you how you and your people could become more productive by just reading this article, would you consider it? I am sure this is not your first rodeo; however, this might be an approach you have not considered working on to increase profits in your business. Plus, if you want to retire, you might want to consider teaching this to your second-in-command. One of our most successful senior coaches, Brian Hunnicutt, teaches the following concept to his client base — with tremendous results.

The 80/20 rule has been around a long time, and works on a wealth of levels, tasks and events. It works on men and women, personal and business. It will apply on many more events, levels and tasks than it won't apply to.

We get 80 percent of the money in a normal business environment from 20

percent of our clients. Men and women both wear 20 percent of the clothes in their closet 80 percent of the time. I have polled a number of people, and both men and women agree to it. If you have a picnic, you can rest assured that 20 percent of the people will eat 80 percent of the hot dogs.

What we accomplish in 20 percent of our day nets us 80 percent of the results for that day. Figure that there are 24 hours in a day, and we sleep for eight hours. That leaves 16 hours to be productive. So what you accomplish in 3.2 hours will net you 80 percent of the results for that day. Think about your day, and how you manage the events in that day. Does this apply to you? Is there any way you could stay in "20-percent land" longer?

## Stay productive longer

The challenge, once you start realizing the truth about the rule, is to start

defining the tasks that place you in 20-percent land, and the nonproductive tasks that are in 80-percent land. I would have you write down all the tasks that place you in 80-percent land, and then come up with a process that allows you to be *proactive* instead of reactive. I have found that most 20-percent actions are the tasks for which we have proactively defined a process that keeps us on task.

Take paperwork, for example. When you sit down to do it, the phone is ringing off the hook and all the activity around you keeps pulling you away. The shiny pennies and squirrels keep distracting you. In other words, you were not proactive in creating a process to stay focused on the paperwork. Why not come in early or stay late? You could even tell everyone that you are at lunch and get it done. It will probably be done right with fewer mistakes, and it will not have taken but a fraction of the time. You will have been in 20-percent land.

Think about all the shops around you. Most are slow, but a couple of them are really busy. The 80/20 rule is hard at work here. If you put a bowl over 10 shops, two of those 10 will produce 80 percent of the sales for all 10. I know that this sounds crazy, but look around.

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## CHUBBY'S BONUS TIP: WHAT IS THE BEST WAY TO STOP SALES FROM SWINGING VIOLENTLY MONTH-TO-MONTH? DEVELOP A SYSTEMATIC SALES PROCESS, WRITE IT DOWN AND INSPECT IT DAILY UNTIL IT BECOMES A HABIT.

Put the bowl over 10 service advisors, and the same is true. It even works for the techs. It has always amazed me to have a tech that can produce 60, 70, 80 or even more than 100 hours in a week — only to have the rest of the people in the shop combined not be able to produce what that one does.

### Teach them to break the rule

We need to address what is getting in our own way and our employees' way. Have meetings as a shop and one-on-ones to help everyone stay on task and learn how to beat the 80/20 rule.

What are some of the things that get in the way of our techs? Talking to each other, bathroom and smoking breaks, unorganized toolboxes and carts are just some of the struggles. But I would say the biggest is that we don't teach them how to break the 80/20 rule. We don't create the clear level of expectation and then track it and measure so that we can hold them accountable.

When we are dealing with our customers dropping off their cars, it would be prudent to spend the extra couple of minutes building the relationship and educating them about what we are going to do with them and for them. If we don't take the extra time, then we might do a great courtesy check and build a fantastic estimate — only to not make the sale. Thinking that you did not have the time during the drop-off to educate your clients did not save time; in fact, it cost you much more time than you would ever realize.

Being proactive in understanding each task and learning whether the task is a 20 percent or an 80 percent item is critical. We need to prime the pump if we are going to get water out of the well. If our customers are not expecting the call when we make it to sell them additional work, then it is like sneaking up on them with bad news — vs. fulfilling your responsibility to inform your customer. Customers need to be expecting the call, so they will have had a chance to discuss it with their significant other or whomever. That way, we have a greater chance of



them being in the 20-percent group and buying everything. It is when we don't let customers know what and why, that they stay in the 80-percent group.

### Don't let customers sell you

The 20/80 is the other side of the 80/20 rule. It is the 20 percent on the reverse side that takes 80 percent of your time and you get nothing out of it. It is the 20 percent of the clients that proactively try to control your sales process and take 80 percent of your effort and you get nothing out of it. These customers try to make you feel uncomfortable asking for the sale. It can take many shapes and forms, but the end result is always the same: You lose.

Now, we understand that two out of 10 are buyers and two out of 10 are proactive nonbuyers. The other six out of 10 are the ones we are trying to turn into the 20 percent that buy everything. By enhancing your processes, you stand a good chance of doubling your current business by beating the 80/20 rule. You can have 30 percent, 40 percent, even 50 percent or more buying what you recommend when you recommend it.

The real problem is that for each one of the six that turns into an active

buyer, you stand an equal chance of one of them turning into an active non-buyer — this is the reverse side of the 80/20 rule. All of the active nonbuyers will try to make you afraid, doubtful and hesitant to even approach them to ask for more money. In other words, they sold you on not selling them. The customer's job is to say no; they will sell you on not selling them.

Understand these truths: "Nothing happens until a sale is made" and "There is nothing a sale won't fix." Either you are selling the customer or they are selling you.

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Chris "Chubby" Frederick is the CEO and founder of the Automotive Training Institute. ATI's 108 associates train and coach more than 1,150 shop owners every week across North America to drive profits and dreams home to their families. Our associates love helping shop owners who are having the same struggle as many of them have had, and who are looking for the same answers, and in some cases looking for a lifeline. This month's article was written with the help of Randy Somers, ATI's head instructor, who has had decades of experience at the front counter.

 E-mail Chubby at [cfriderick@autotraining.net](mailto:cfriderick@autotraining.net)

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Chris "Chubby" Frederick, CEO



# THE NEW FORMULA FOR CULTURE

AS YOU PREPARE TO MOVE FORWARD, IT'S TIME TO DEVELOP AND MEASURE THE NEW SHOP CULTURE REQUIRED IN TODAY'S AFTERMARKET.

BY **BOB GREENWOOD** | CONTRIBUTING EDITOR



**THE** average shop owner across the country has experienced a challenging couple of years, and the challenges are about to grow with the introduction of the connected car through telematics. But while many owners appear to carry on their business the best they know how, the bottom line for the effort put in just isn't there. In fact, too many shop owners have bought themselves a job — they know it, but they lack the self-confidence to address the problem.

The main reason for the lack of a

bottom line is too many shop owners have not focused on the “core culture change” that is required to drive a proper return on investment (ROI). In order to enjoy a great ROI, the shop must have a great business net income after a professional owner/management wage has been paid and after the income tax on the profits of the shop have been factored in.

Consider that perhaps it is time to define the change required into a mathematical formula format. As everyone knows, math does not lie, but the

formula must be understood and one must practice with it to master the outcome desired. Let's be honest, the real enemy in achieving any business suc-



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cess is the self-discipline to execute, so a discipline of practicing over and over is very necessary.

To prove that you are capable of getting through the issues of your shop from a business management perspective, take some time by yourself and work through the formula. Analyze and answer the questions about your own operation using this formula format, with the letters in the formula representing the following definitions:

$$NP = CA + CS + RBM$$

SLE (2)

- NP - Net Profit
- CA - Correct Attitude
- CS - Competent Staff
- RBM - Right Business Measurement
- SLE (2) - Service Level Execution Squared

### Net profit

This is the ultimate objective to be achieved within the business. A successful maintenance and service shop will achieve a net income before tax of at least 10 percent of total sales. This is after management has been paid a professional wage for managing the company.

Unfortunately, too many shops have been taught by the industry and seminars attended to be top-line driven — they measure sales and gross profit made on the sales. They do not measure, and have not been taught to measure properly, net profit per work-order/invoice before they close off the estimate or transaction with the customer/client.

To achieve the right net profit in a shop today, management first must learn how net income is created in a service business. The question to ask yourself honestly is, "Do I think and measure net profit in my shop, or do I think and measure sales in my shop on a daily basis?" If you watch sales, then you must enroll yourself into an industry-specific business course that will teach you how to measure net profit per work-order/invoice.

It is most unfortunate, but it has been proven time and time again that, on average, 60 percent of the work that goes through the average shop's doors does not create \$1 of net profit; this work only creates shop activity (sales) and gross profit. This is a busi-

ness measurement process that must be understood.

### Correct attitude

Everyone acknowledges that you can feel the attitude of a shop the moment you walk into it. Consider that your customer/clients also can feel the shop's attitude. Is your shop a positive or negative experience?

When management has the right attitude, they can address and fix every, and any, problem within the shop. When

management has a closed attitude — that is, not willing to listen, properly evaluate and try other options to running the business — then the bottom line profitability is definitely affected.

Having the correct attitude is the No. 1 step in turning a shop around. One cannot even start to address building proper net income if management has the wrong attitude about the topic. Understand the definition of attitude:

CONTINUES ON PAGE 108

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## OPERATIONS

## SHOP PROFILE

A snapshot of one of the industry's leading shops

SHORES CAR CARE / ST. CLAIR SHORES, MICH.



# You are what you market

Just because the shop is outside of Detroit doesn't mean it's experienced a similar economic fate.

BY **ROBERT BRAVENDER** | CONTRIBUTING EDITOR

**Y**ou might assume opening a repair shop post-Sept. 11 would have been risky; opening said shop in metropolitan Detroit during an economic downturn perhaps more so. That doesn't mean it can't be done.

In 2002, the Fujarski family — father Larry, sons Karl and Nate — bought Shores Car Care in St. Clair Shores, Mich.

"I think in retrospect it was probably the worst time we could have gotten started," admits Nate Fujarski. "Basically we just tried to position ourselves; my father and brother both had extensive dealership backgrounds (Larry as an assistant service manager with Buick, Karl as a lead VW/Audi technician), so we went with the professionalism and appearance."

It had been an existing business, so they had a "bit of a database" from which to work, Fujarski says.

"In the beginning, we created some marketing campaigns to introduce ourselves to current clients, but it took a couple of years to really establish a

direction through trial and error," he adds. "And we realized that what you market is what you get: If you market something very low and inexpensive, you're going to get just those people that want low and inexpensive. So we tried to toe the line between high and low, and positioned ourselves right in the middle."

### Networking is key

The trio had the German marques as a base, which they expanded by recruiting technicians, but things really started coming together after the Fujarskis began networking with Top 20 groups. "That really helped us develop a better structure," notes Fujarski. "We were able to bounce some ideas off these guys, not to mention we could learn from their mistakes."

## AT A GLANCE

### Shores Car Care

Shop name

**Larry, Karl & Nate Fujarski**

Owners

**St. Clair Shores, Mich.**

Location

**1**

Number of locations

**12**

Years in business

**7**

Total number of employees

**5**

Number of technicians

**7,900 square feet**

Shop size

**8**

Number of bays

**58**

Average vehicles per week

**\$293**

Average repair order

**\$890,000**

Annual gross revenue

**Bosch Authorized**

**Service Center**

Shop affiliations

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**(15) 4th Place \$200 Amazon Gift Card**  
Sponsors: **EXIDE**, **DELPHI**.

**(20) 5th Place - iPod Nano**  
Sponsors: **EAST PENN** manufacturing co., Inc., **AutoLite**, **TIMKEN**, **NGK** SPARK PLUGS.

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Key to that structure was developing a procedural book.

"I think when you reach the volume we're at, around \$1 million a year, there has to be structure — from point A to point Z, from our customer service representatives, to our service advisors, to our technicians," says Fujarski. "It's a big puzzle; we took bits and pieces from people who were doing a portion of those things, and just refined it to our business needs. It is

by far one of the best moves that we've made, because it allows everybody to know where everybody is at any one time."

The system also allows the management team to see clearly where a breakdown is and to attack a problem quickly. "Developing our process took us a couple of years of accessing and putting that into black and white," Fujarski recalls. "We feel we have done our homework to make sure this pro-


cess is wired. Of course things will change, and we'll make those adjustments. We always solicit feedback, and we put that in our Monday staff meetings. We empower our staff. We want them to run the facility, because they're the people that make or break us."

Should a problem involve obtaining a particular tool for a particular vehicle, they'll immediately do so. "We never want to turn a job away," Fujarski affirms. "We have a great rapport with our tool vendors to make sure that if we don't have a tool available, they'll get it to us; we've been overnighted tools numerous times to get the job done."

"It may seem like a one-time hit, a big expense to get a particular job done," adds Karl Fujarski. "However, it also opens up more opportunities for the particular vehicle that required the tool. There have been shops in the area that realized they didn't have the necessary equipment to do a particular job, and they've actually sent those customers to us. We've got our footprint in this area; people know that even though they may be at a different shop, if that shop isn't able to get the job done they'll farm them out to us."

That footprint also extends to their web presence. "When Facebook first came out, we thought, just as many businesses did, that it would be a great





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selling tool,” Nate Fujarski reports. “But for us, Twitter and Facebook have been more of a way to just stay in front of the public and make sure we’re on top when they think about repairs; once a week we post and send out a Tweet. That’s where we’ve taken our social media presence, and we’re actually having a new website built. It will be a little more interactive, and online tools like scheduling are awesome because it’s such an automated world these days — nobody really talks on the phone anymore!”

**“We’ve got our footprint in this area; people know that even though they may be at a different shop, if that shop isn’t able to get the job done they’ll farm them out to us,”**


— Karl Fujarski

### Looking ahead

The past few years also have seen nearby Detroit go through its worst economic downturn yet. “I would say it’s definitely had an impact,” states Nate. “But we have provided a product that we think is good and is going to be here a long time, and I think people respect that. It’s always been a price-driven industry and always will be, but where we try to separate ourselves is with honesty and integrity.”

And there are plans for expansion. Because their father spends part of the year down in Florida, the Fujarskis are looking at facilities down there to purchase, as well as possibly another shop in Michigan.

“The goal has always been three shops, there being one for each of us,” Nate explains. “We are very conscious of where we’ll go and what we’ll do, but we want to make sure that our home base is secured and it’s wired, meaning it operates 100 percent by itself, before we dive into the next venture. It’s a journey; there are a lot of things out there that we could jump into, but it’s just not the right fit yet.

“We’ve reached a point in our sales that a lot of shops haven’t,” he concludes. “And of the ones that have, I want to stress that a lot of the shops out there doing \$2 million include car sales, body work, etc. We are solely a repair facility; there is no other revenue that we generate. That million-dollar plateau, that’s a good feather in our cap.” 



**ROBERT BRAVENDER**  
CONTRIBUTOR

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

 Email Robert at [rbravender@comcast.net](mailto:rbravender@comcast.net)





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# Park problems with Dodge RE transmissions

**A REDESIGN IN 2002 ALTERED THE GEOMETRY OF THE PARKING ROD.**

BY **WAYNE COLONNA** | POWERTRAIN PRO PUBLISHER

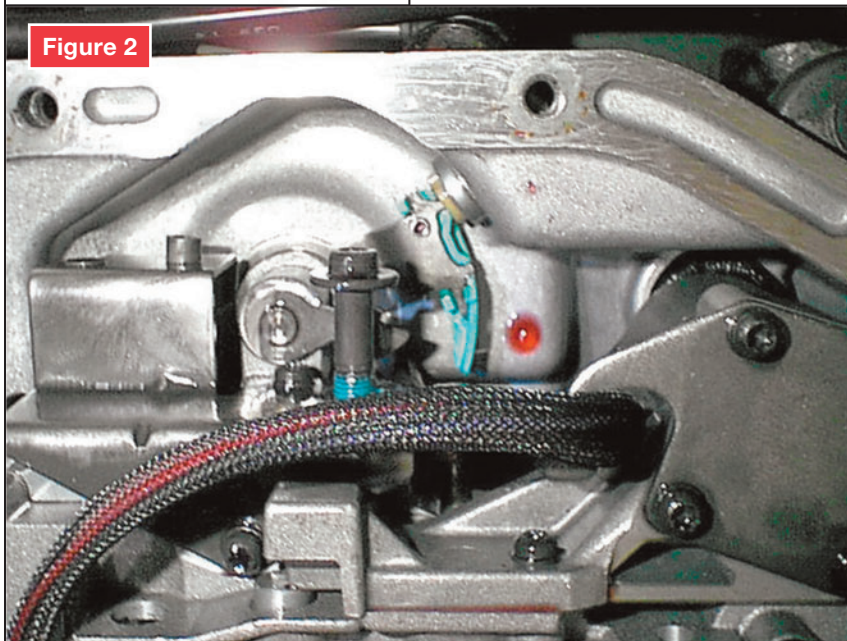


**Figure 1**

**DODGE** RE series transmissions originally began using a simple Park/Neutral Switch as seen in Figure 1. This switch rides on a cam located inside the transmission. The cam is part of the manual valve linkage and park rod (Figure 2). In 2002, the switch was replaced by a Transmission Range Sensor, as seen in

Figure 3. To accommodate this change, the internal cam was redesigned (Figure 4). This also altered the geometry of the parking rod (Figure 5).

The original length with the three-pronged Park/Neutral Switch was approximately 14 3/4 inches in length. The Park rod for the new TRS is approximately 14 5/8 inches in length.



**Figure 2**



**Figure 3**

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

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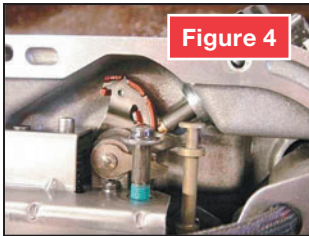


Figure 4



Figure 5



Figure 6

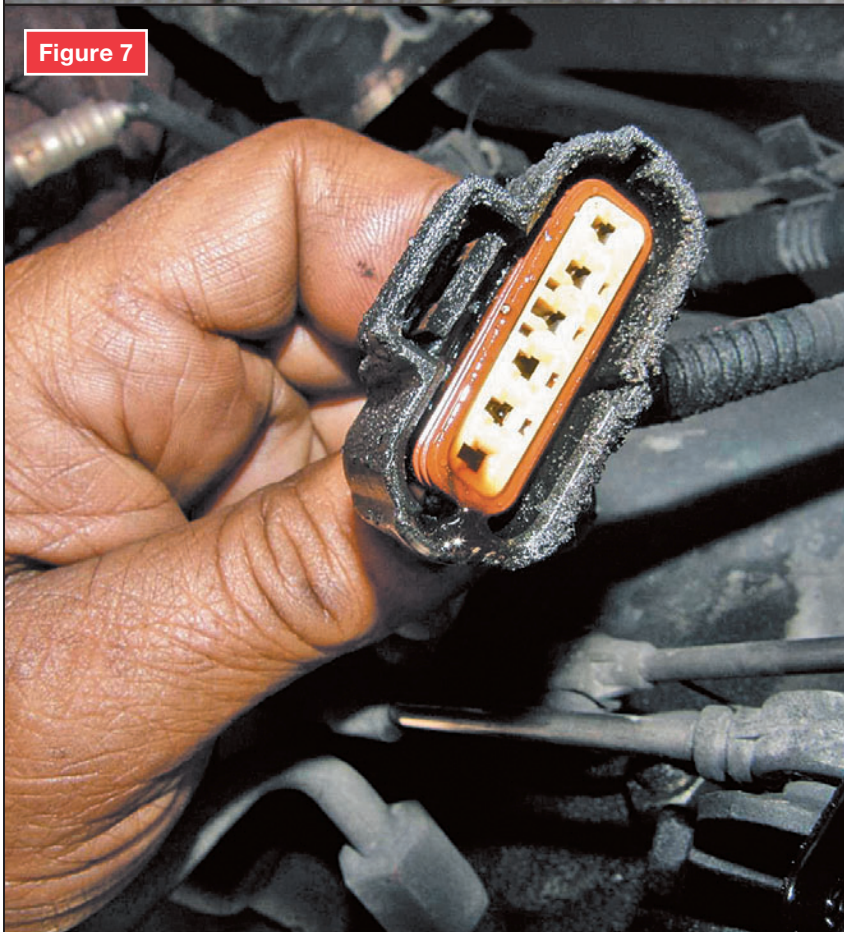


Figure 7

Interchanging these rods will interfere with the proper operation of a Park engagement. Additionally, the 48RE transmission in Dodge diesel application has a wider bullet base with which to wedge the park pawl into the park gear (Figure 6). The 46 and 47 RE units the width is 0.547 inch, while the 48RE is 0.724 inch. This, too, needs to be observed when swapping out valve bodies or internal linkages for Park to engage correctly.

One common failure with the Transmission Range Sensor is the internal plunger bushing wearing, allowing transmission fluid to enter the sensor. The fluid will eventually load up the connector (Figure 7), causing range sensor signal problems. This signal is hard-wired into the instrument cluster.

The instrument cluster then broadcasts this signal over the network to the computer controlling the transmission's shifting. Because diagnostics could potentially become erratic, unplug the sensor for a quick visual before getting overly involved in the system. **TZ**

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# IRONING OUT FORD 5R55N/S/W CLUNKS AND BUMPS

BY WAYNE COLONNA | POWERTRAIN PRO PUBLISHER

**THE** design of the OD planetary gear set (Figure 1) in the 5R55N, S and W transmissions allows for a 1:1 ratio from the Input Shaft to the Center Shaft until the Overdrive Band comes on and holds the sun gear. When this happens, the Input Shaft will spin slower than the Center Shaft.

Ford Motor Company's 5R55 W/S & N Transmissions Theory and Operation manual provides the following gear ratio information:

	5R55W	5R55S	5R55N
<b>1st gear:</b>	3.22:1	3.22:1	3.22:1
<b>2nd gear:</b>	2:41:1	2.29:1	2.41:1*
<b>3rd gear:</b>	1:54:1	1.54:1	1.54:1
<b>4th gear:</b>	1:00:1	1:00:1	1:00:1
<b>5th gear:</b>	0.75:1	0.71:1	0.75:1**

\* (early); 2.29:1 (later)  
 \*\* (early); 0.71:1 (later)

By looking at these ratios, the main difference occurs in both the second and fifth gears. This is when the Overdrive Band applies, causing the OD planet from being locked at 1:1 to overdriving at either 0.71:1 or 0.75:1.

There are two different OD Planetary assemblies. They are as follows:

**Set 1**

- Overdrive Ring Gear: 94
- Overdrive Sun Gear: 38
- Overdrive Pinion/Carrier: 28

**Set 2**

- Overdrive Ring Gear: 72
- Overdrive Sun Gear: 24
- Overdrive Pinion/Carrier: 25

To determine which Overdrive Planetary Assembly provides the 0.71 or 0.75 ratio, the Ring Gear teeth count will need to be divided by the Ring Gear teeth count added to the Sun Gear teeth count (Figure 2).

**Set 1:**  $94 / (94 + 38) = 0.71$   
**Set 2:**  $72 / (72 + 24) = 0.75$

Lubrication problems are known to destroy this planetary assembly requiring the need to replace it. Incorrectly interchanging these two assemblies can cause a variety of issues.

The Lincoln LS, for example, was originally equipped with a 5R55N, and was changed to a 5R55S around 2003. It seems that the computer strat-

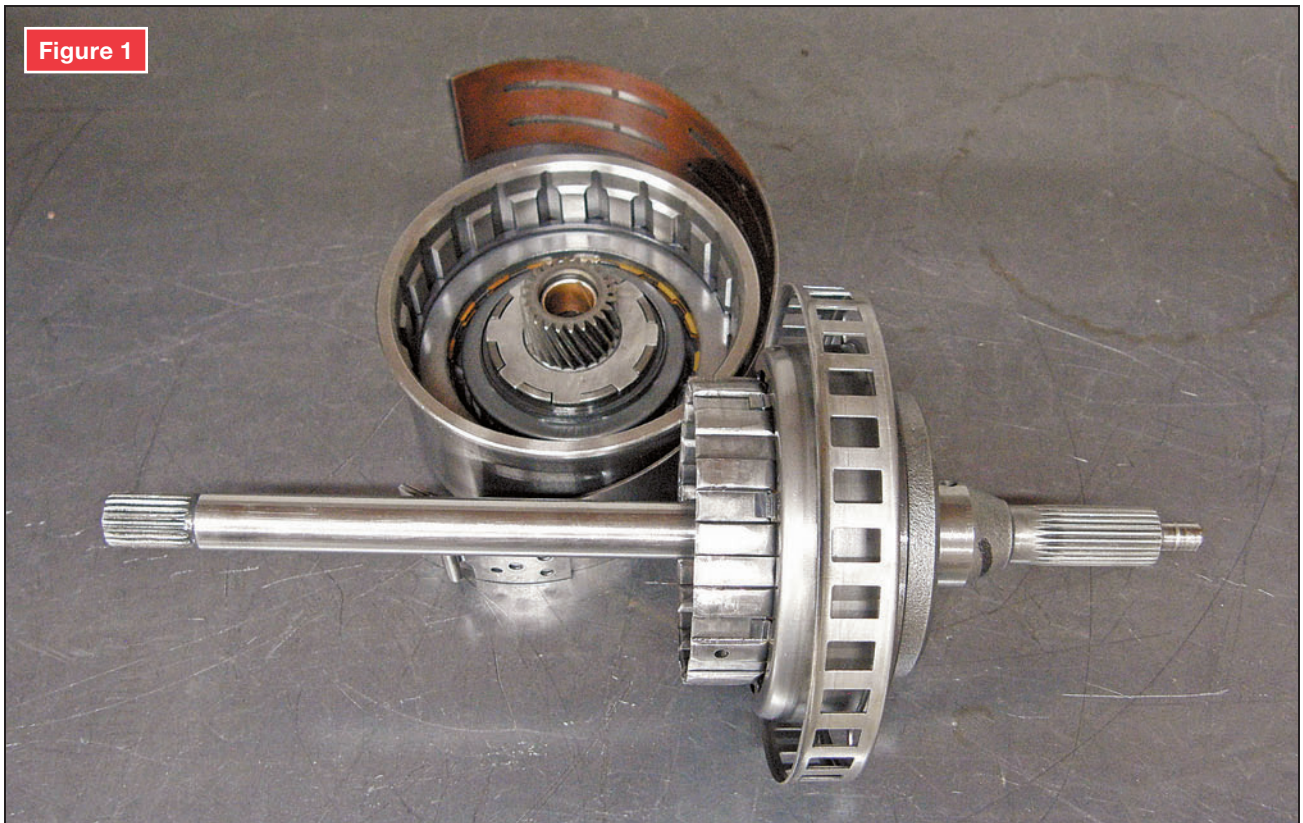


Figure 1





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egy in the Lincoln has a tight window on ratio tolerancem causing it to be very sensitive to variations. Should the wrong ratio OD planets be used, gear ratio error codes are produced — followed by harsh shifting.

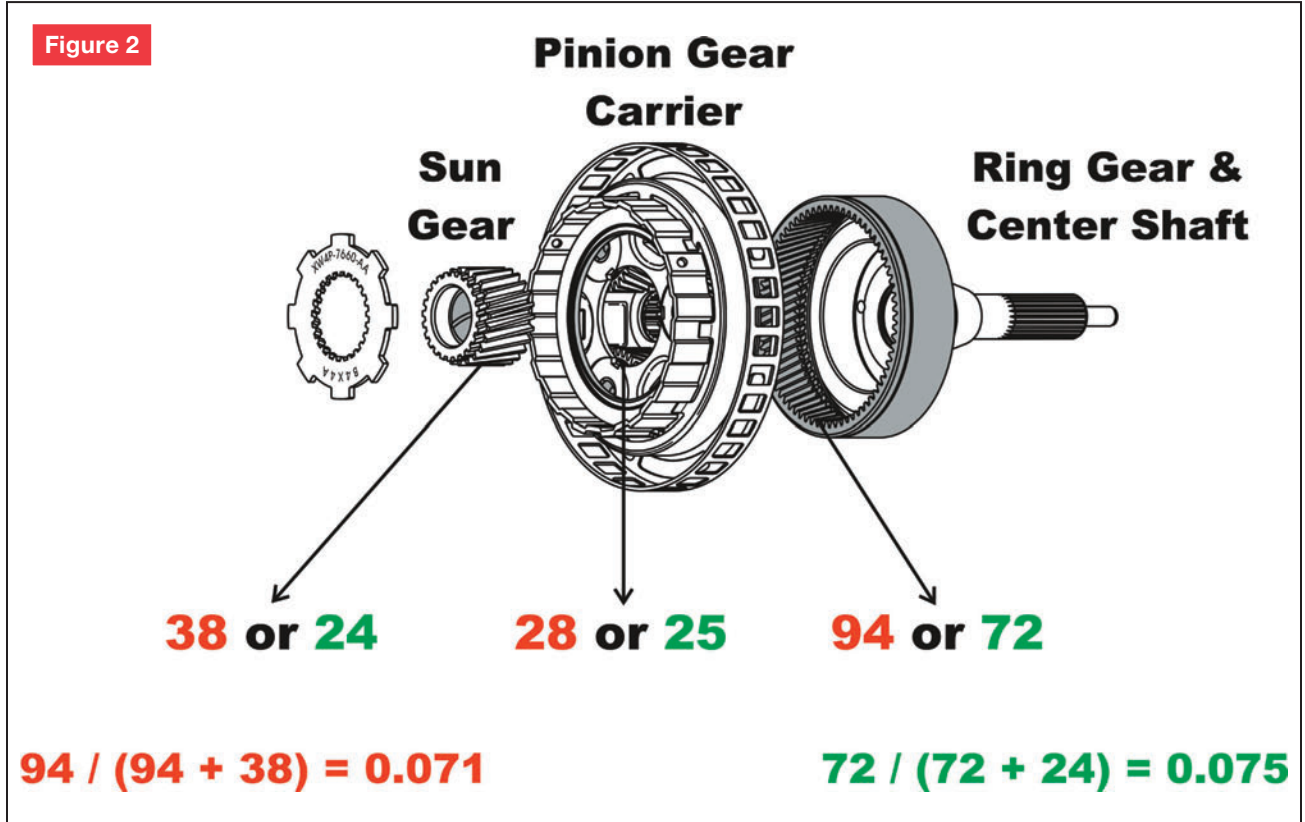
Otherwise, the vehicle could develop

a harsh 1-2 up-shift and/or 2-3 shift the longer the vehicle is driven, and may not have any codes present. Other times, gear ratio error codes such as P0732 and P0735 may accompany the complaint. They may also have coast downshift clunks.

In the cases of Mountaineers and

Explorers, they seem to be less sensitive. In fact, anything earlier than 2004 doesn't seem to be an issue.

Starting around 2004 and later, we have noticed an increase in the sensitivity of ratio tolerances — which may explain why in some models there are



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no apparent side effects, while in others there are.

What makes these a bit more elusive is that in many cases a harsh or bumpy 1-2 up shift occurs the warmer it gets, yet there are no codes. Sometimes it is the 2-3 shift that gets harsh. Downshift clunks and bumps may also be present — yet no codes. Sometimes there will be codes, and servo bores and valve bodies are blamed, yet it's the wrong OD planet ratio.

### Step by step

One way to determine whether the wrong OD planetary ratio has been used is to first erase the Keep Alive Memory with a scanner. Then perform the following garage shift relearn procedure:

1. Ensure that the transmission fluid level is correct.
2. Install diagnostic equipment and monitor TFT.
3. Warm the transmission fluid to 54°C (130°F) as indicated by the TFT.
4. Perform five engagements from Park to Reverse. Each engagement must be five seconds apart.
5. Perform five engagements from Drive to Reverse. Each engagement must be five seconds apart.
6. Perform five engagements from Reverse to Drive. Each engagement must be five seconds apart.
7. Perform five engagements from Neutral to Drive. Each engagement must be five seconds apart.


Then perform the following drive learn procedure:

8. With the shifter in the (D) or (D5) position, moderately accelerate from a stop to 80 km/h (50 mph). This allows the transmission to shift into fifth gear. Hold vehicle speed and throttle position steady for a minimum of 15 seconds.
9. With transmission in fifth gear and with steady speed and throttle position, lightly apply and release the brake pedal to operate the stop lamps. Then, hold steady the vehicle speed and throttle position for a minimum of five seconds.
10. Brake to a stop, and remain stopped for a minimum of 20 seconds.
11. Repeats steps 8 through 10 at least five times.

If the harsh shifts no longer exist at initial start up, but begin to get worse as it is driven, chances are you may have the wrong OD ratio set. This is especially the case if the servos and valve body have been addressed and you know that the OD planetary was changed.

Usually the 38-tooth sun gear is the most prone to destroying the OD planet set, causing the need for replacement. But if you are not sure

what originally belongs in the vehicle, the most inexpensive and sure way of knowing is to call the dealer — and with the vehicle's VIN, order the washer/adaptor that spline onto the OD Sun Gear and locks it to the Coast Clutch Drum (Figure 2). The basic part number for this piece is 7660.

If the washer fits the sun gear, you have the correct OD planet system. If it does not, the right assembly will need to be acquired and installed. 

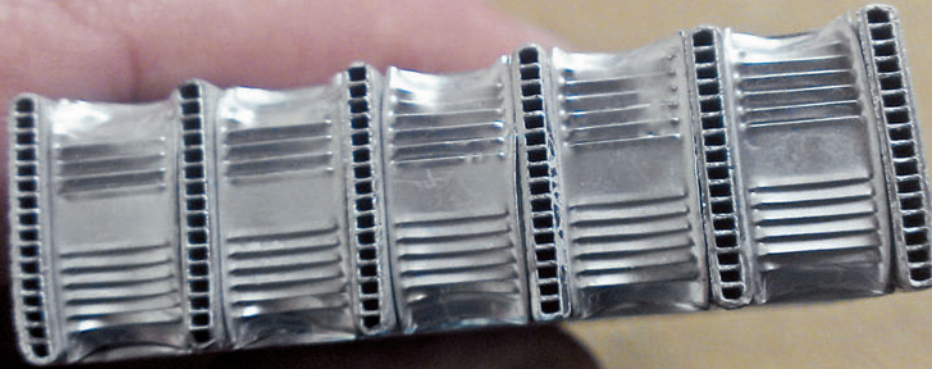
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These passages are pretty small. You sure that blow tip flush gun is going to clean out all the debris?

# JOURNEY TO NEW ORLEANS

## INSIGHTS AND REFLECTIONS ON THE 2014 MACS TRAINING EVENT AND TRADE SHOW.

BY **PETE MEIER** | TECHNICAL EDITOR

It's kind of weird penning an article that covers what I learned and experienced at the 2014 Mobile Air Conditioning Society's training event and trade show in January in New Orleans, when the cold, stiff hands of Old Man Winter still have an icy grip on most of the country. But hopefully, by the time this feature appears in your hands, spring will be

well underway and the blustery conditions suffered by many will be fading into the fog of unpleasant memories.

### Training focus on Day Two

Wait a minute, what happened to Day One? At this event, Day One is reserved for fun — with golf, bowling or, if you're like me, familiarizing

yourself with the scheduled classes and meetings.

So, the real action begins on day two, and that's where my story starts. In the past, it was my practice to peek in on several classes to gain an overview of what was being taught, but this year I wanted to be

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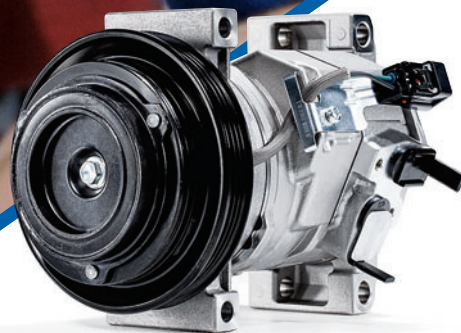


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a student as much as a reporter and decided to choose among the variety of classes offered and sit through the entire session. That first morning of training found me sitting in on a class on "New Perspectives On A/C Repair," taught by Richard Sheffield. Being the "geek" that I am, I was intrigued about some of the techniques the course description said he would be sharing as part of his presentation. I never heard of using a Digital Storage Oscilloscope (DSO) and pressure transducers being used for A/C testing before.

Sheffield's class began by focusing on common mistakes many techs



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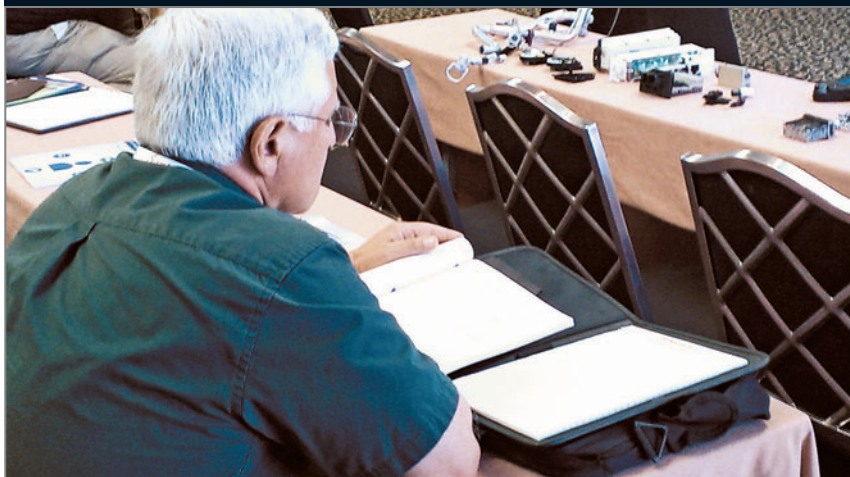
across the country still make when servicing more modern A/C systems. Many of these tips you've read about in the pages of our magazine, and the consequences of not being up-to-date with current servicing procedures include repeat compressor failures, systems that won't cool as they should and irate customers.

"But I've always done it this way" is a typical response offered by these technicians," Sheffield told the class, asking us whether we were one of "those guys."

One common mistake worthy of discussing here is equipment maintenance. Having worked in a number of



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Attendees put on their 'back to school' game faces for classes at the MACS event.



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different shops over the years, I can testify to the fact that recovery/recycling/recharging (RRR) machines are woefully ill-maintained. Filter reminders are reset (rather than replacing the filter), and vacuum pump oil rarely is changed. And even though current SAE standards governing the capabilities of RRR machines has been in place for several years now, I'm willing to bet that many of you reading this article are still using old equipment that does not meet these

new standards. And that means you are not recovering all of the refrigerant that you should, and you are not charging repaired systems with the correct amount of clean refrigerant.

Another valid point Sheffield raised was the proper method of ensuring all of the moisture is removed from a system before recharging. I've witnessed personally repairs where the accumulator (or receiver-drier) was not replaced as part of the repair. I've also seen systems that were not evac-

uated prior to charging a repaired system, ensuring that air would be present (resulting in higher pressures and lower cooling efficiency) and any moisture trapped in the system's oil would remain there.

Sheffield pointed out two critical mistakes that are often made in the field. First, deciding on how long a system needed to remain in vacuum in order to successfully cause the moisture to vaporize and be removed (dependent on outside air temperature and amount of vacuum applied). Second, adding moisture to a system inadvertently by using PAG oil from an unsealed opened container. PAG oil is hygroscopic, absorbing water from the air if left open. Moisture in the system can lead to corrosion and damage to the mostly aluminum components that make up a modern air conditioning system.

Additionally, Sheffield commented on the importance of testing the system as outlined by the OEMs. Some makes require the doors open, hood closed. Some doors closed, hood closed. And some require testing with everything open. The only way to make sure your test results are accurate is to first review the test procedure in your service information system. He also stressed a point that bears repeating here. It is vitally important that oil and refrigerant charges remain in specification. Modern systems (made during the last 10 years or so) use much smaller oil and refrigerant charges and have less tolerance for error. Too much oil can act as an insulator inside the heat exchangers (condenser and evaporator) and impede the heat transfer necessary to effective system operation. Too little oil speaks for itself, resulting in catastrophic compressor failure that often spells expensive repairs requiring the replacement of related system components. Too much refrigerant results in lower cooling efficiency and higher pressures and temperatures in the compressor while too little refrigerant can impact oil flow through the system and cause a loss of cooling ability.

During his class, Sheffield also shared two techniques that he uses routinely for diagnosing A/C system performance. The first he shared was

## NOTHING BEATS LIVE

Before I dive into the specifics I learned from my time in New Orleans, I want to share something that I feel is extremely important. It's no secret that our industry (that's you and me) faces increasingly complex challenges. The technology and systems growth we've seen over the last decade is only the beginning of what we'll face in the future. Telematics and autonomous driving systems, for example, are close to becoming an everyday reality, and will change the face of the automotive industry in ways we can only imagine today. Nearly every system on the car that can be made electronic has or soon *will* be made electronic. And a vehicle's tolerance for improper or sloppy repairs is dwindling to almost non-existent. Consider the impact sensors placed just 1mm out of specification can cause an airbag to deploy too early or too late, causing injury where it should have been prevented.

Yes, the pressure on professional technicians to maintain and continue the development of their skills is greater than ever in our industry's history. The training opportunities, though, for accomplishing those goals are also at an all-time high. In addition to traditional methods, like night classes at the local vocational school and keeping up with the industry trades, there are numerous digital opportunities to get the training you need. You already know about the quarterly webinars both *Motor Age* and POWERTRAIN PRO offer for free, right? Many aftermarket companies offer the same (some for free, some for a nominal charge), while others host online video training libraries you can access at your leisure.

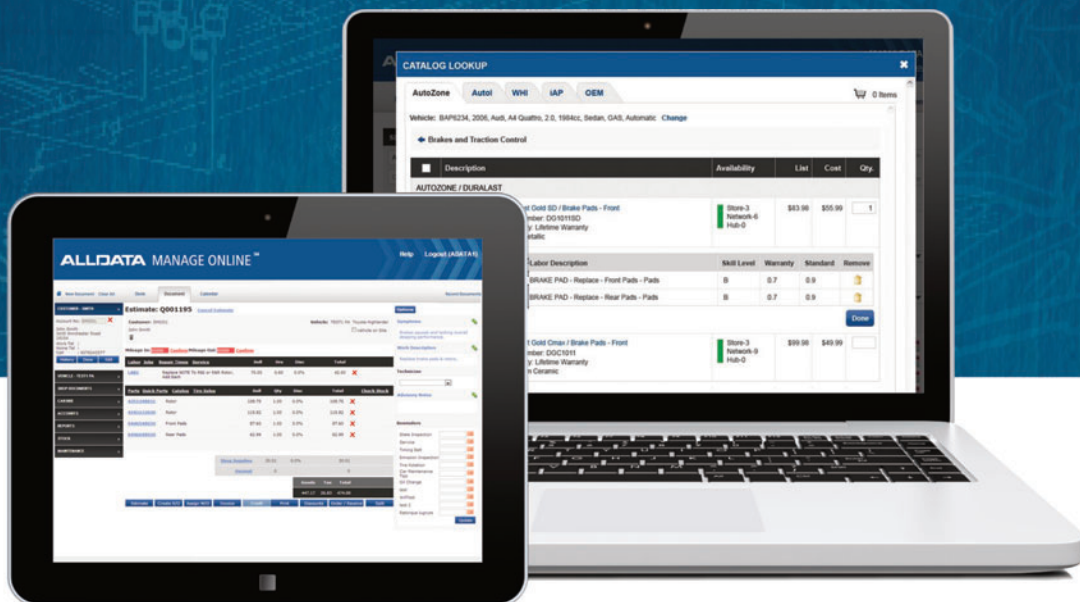
Many of these offerings are top-notch

and are a good way to stay informed or to hone your current skills. But nothing, and I mean nothing, beats attending a training session (delivered by a capable instructor) live and in person. Attending events, like the MACS training event, is one way to get that kind of high-caliber training. The advantages are many. First, you gain interaction with the instructor immediately. Second, you learn from others attending the same class by sharing each other's experiences, learned through the battle of executing a proper repair in the real world. Third, you are in an environment conducive to learning. You're away from the shop, away from the demands of customers, even if only for a little while. And, unlike attending a weeknight seminar at the local hotel (not a bad option, but not my first choice), you're not tired from a hard day's work.

Fourth, after the day's learning is over, you can network with your classmates and enjoy the amenities the hosting city has to offer. It's a great way to make connections that can help each other after the event is over and everyone has gone their separate ways. Many great friendships are born at events like the MACS 2014 conference. Having been a professional technician for nearly 35 years, I understand that not everyone can afford to make such a trip. I guarantee, though, that if you do make the investment in yourself and attend one of these events (MACS, VISION, ATE, CAN, etc), you'll be glad you did and you will become a better technician or shop owner in the process.

Now, with preaching portion of my story out of the way, let's move on to the MACS event particulars!

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what drew me to his class in the first place: using a DSO and pressure transducers to aid in compressor diagnosis. The concept was simple enough.

Compressors are mini-pumps, and their pumping cycles can be seen in the pressure signal picked up by the transducer. Sheffield made his own

testing rig by adding pressure transducers to a standard gauge set and powering them independently.

Many cars have pressure transduc-



In between classes, the event luncheons offered a chance to interact with other attendees and listen to great speakers, like Thursday's keynote by Roy Gage.



RRR machines for both R134a and HFO1234yf were on display at the trade show. The new HFO1234yf machines have some interesting features, like a requirement that the in-car refrigerant be tested prior to any evacuation to insure no issues with refrigerant contamination.

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ers already incorporated into the system, so an DSO can be used to monitor the signal they produce. Much like low current testing on a fuel pump, Sheffield claims he can diagnose worn compressors, especially piston-type designs, using this method. And, like many other testing techniques that were first attempted, this technique is new enough to be interesting but not old enough to be proven.

The second technique he shared was not “new” to some of us. That is the use of an anemometer to mea-

sure wind speed. This technique uses wind speed to check air flow through the condenser and/or from the panel vents. Users will have to use it on a lot of “known good” cars to get a feel for what numbers to expect, but it can be an effective way to show a customer why he needs to replace his cabin air filter without going through the effort of actually removing it. Restricted filters, or problems with blend doors and blower motors, can affect the amount of air being passed into the cabin (and across the evaporator).

## More training

All that and more, and that was just the first morning session!

After lunch, I elected to attend a class delivered by ACDelco’s Jerry Mungle. The focus of Mungle’s class was electronic control systems.

Mungle began his class with a statement that holds a lot of truth to it. Today, drivers don’t control their air conditioning systems, computers do. Selecting “A/C” on the dash is only asking a control module’s permission to get cool on a hot day. And the Electronic Control Unit (ECU) with the final say? It’s the Engine Control Module (ECM), and the reason why is pretty interesting.

Compressors place a lot of load on the engine, and that reduces fuel economy and can increase tailpipe emissions. Anything that impacts either falls under the ECM’s control. Pushing the button on the Heating, Ventilation and Air Conditioning (HVAC) control head merely sends a request to the ECM, sometimes indirectly through a third module (typically, the Body Control Module, or BCM).

Troubleshooting these systems is as much about understanding how to use a scan tool as it is pressure gauge interpretation. Mungle strongly sug-



A traditional, and looked forward to, part of the MACS conference is Ward Atkinson’s State of the Industry presentation.



Motor Age Contributing Editor and nationally renowned trainer Bernie Thompson shows the latest ATS product, the Bulls Eye leak detection system, to trade show visitors.

gests that any A/C electronic troubleshooting session start out with a complete system scan, looking for codes in every module on the car. Often, seemingly unrelated codes can lead to the system fault, especially if the problem involves a communication issue between modules.

Along the way, Mungle shared some interesting automotive trivia. For example, did you know that a "stretchie" belt is nothing of the kind? For those that don't know, a "stretchie" belt is the serpentine belt design that uses no tensioner assembly and requires special tooling to install. Many of us were led to think of these belts as big rubber bands, but when you think about it, that doesn't make much sense. If I can stretch the belt to install it, how does it hold tension and why can't I reuse it?

Mungle supplied the answer. The material used to make these belts shrinks when initially heated. After they have been run for a few minutes, they "shrink to fit." Another tidbit shared by our instructor was

the reason for the proliferation of so many electronic control units. The wiring they require is markedly less than the wiring that would be needed to perform the same functions if only one ECU were used. All this thanks to the capabilities of the Controller Area Network (CAN) protocol.

Mungle also told his attendees that more and more, A/C problems will be electrical rather than in the refrigerant circuit. Modern compressors are more robust than ever and systems are sealed so well, leakage is rarely a problem. So break out your scan tool and plug in to known good cars to get a feel for what normal data Parameter Identifiers (PIDs) look like so you'll be ready when that broken car pulls into your bay.

### The rest of the week

This recap was just from the classes I was able to attend on the first day of training, but that's not all the MACS event had to offer. In addition to the classroom training, Ward Atkinson presented his annual State of the Industry address (*Editor's Note: See*

"The new A/C challenges," page 86) as well as an industry trade show featuring a wide array of vendors and aftermarket representatives.

As the technical editor, I get to attend and report on events like this one all over the country. Training events like this one get you thinking, ignites your thirst to learn more, and allows you the opportunity to focus on quenching that thirst. If you've never been to one, try to attend one near you in the next 12 months. You won't regret it. *TM*



**PETE MEIER**  
TECHNICAL EDITOR

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

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Figure 3



# IN-VEHICLE REPAIR

LET'S INVESTIGATE A NO-FORWARD MOVEMENT ISSUE WITH THE AS68RC TRANSMISSION, AND HOW TO DO A COMMON RING REPAIR ON A RE5R05A TRANSMISSION.

BY WAYNE COLONNA | POWERTRAIN PRO PUBLISHER

**O**ne common complaint with the AS68RC transmission (Figure 1) is that it comes into the shop with a no-forward movement in the D range, but does move in Manual Low. This is a typical complaint of a transmission that uses a mechanical one-way clutch device on a Drive take-off that has failed.

The one-way clutch device allows for a freewheel coast. In the Manual Low position, however, a band or another

set of clutches apply to provide engine braking on coast down overriding the use of the mechanical one-way clutch. Knowing that the vehicle moves forward in Manual Low and not in Drive is indicative of this failure.

The one-way clutch device in the AS68RC transmission is called the F1 sprag (Figure 2), and it is known to fail. The good news is this sprag can be replaced without pulling the transmission.

With the transmission in the vehicle, the rear sprag can be replaced by removing the extension housing or transfer case. The output shaft or intermediate shaft and parking gear can then be removed exposing the F1 sprag for service (Figures 3 through 6).

Once a new sprag is installed, be sure that the inner race turns counterclockwise and locks clockwise. This sprag is usually installed and checked



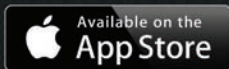
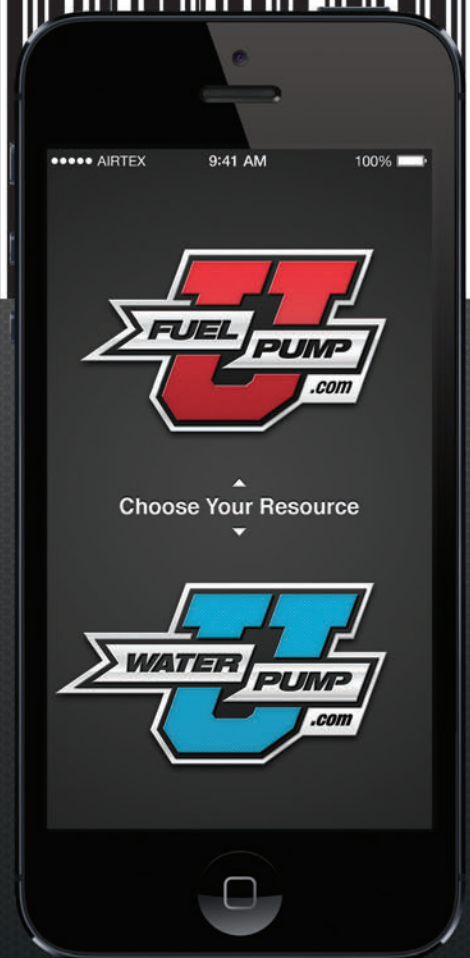
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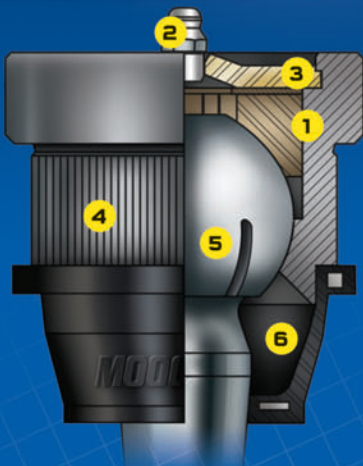
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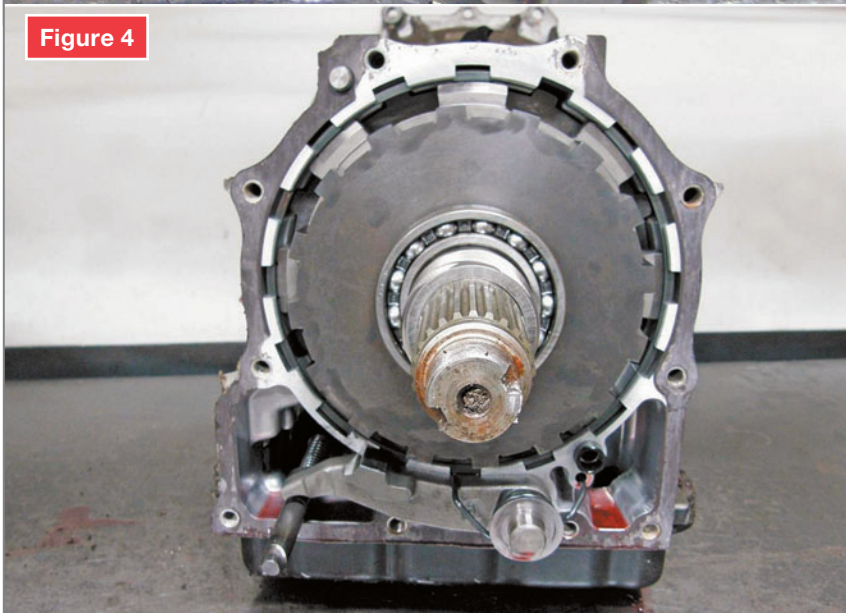
Figure 1



Figure 2



Figure 4



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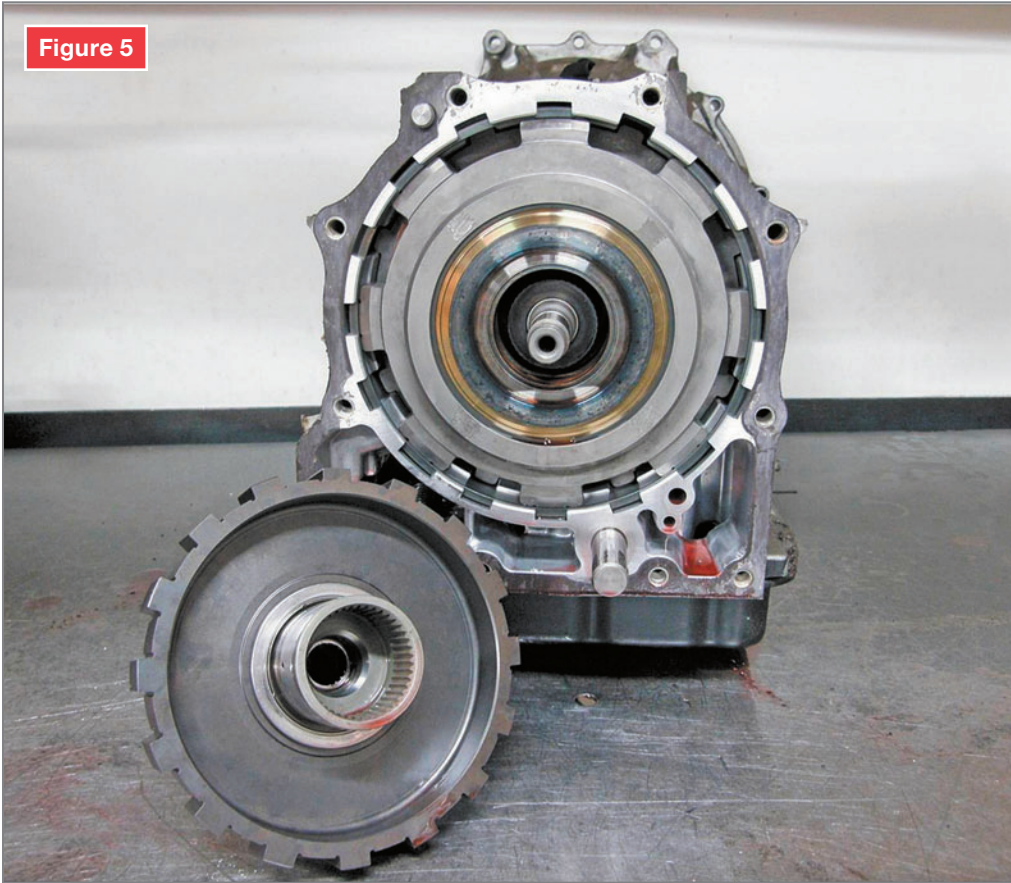


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Figure 5



from the front of the transmission, in which case the inner race would rotate clockwise and lock counterclockwise.

The AS68RC transmission is used in Dodge diesel incomplete chassis, Isuzu cab over, Mitsubishi Fuzo and Nissan UD vehicles.

### Ring repair

The rings on the output shaft of an RE5R05A ride inside a sun gear shaft. Two of the four rings on the sun gear shaft seal feed pressure to the High and Low/Reverse Clutch. These sealing rings are easily broken if not placed onto the shaft carefully. The rings on the output shaft separate lube pressure from clutch pressure. When an

Figure 6

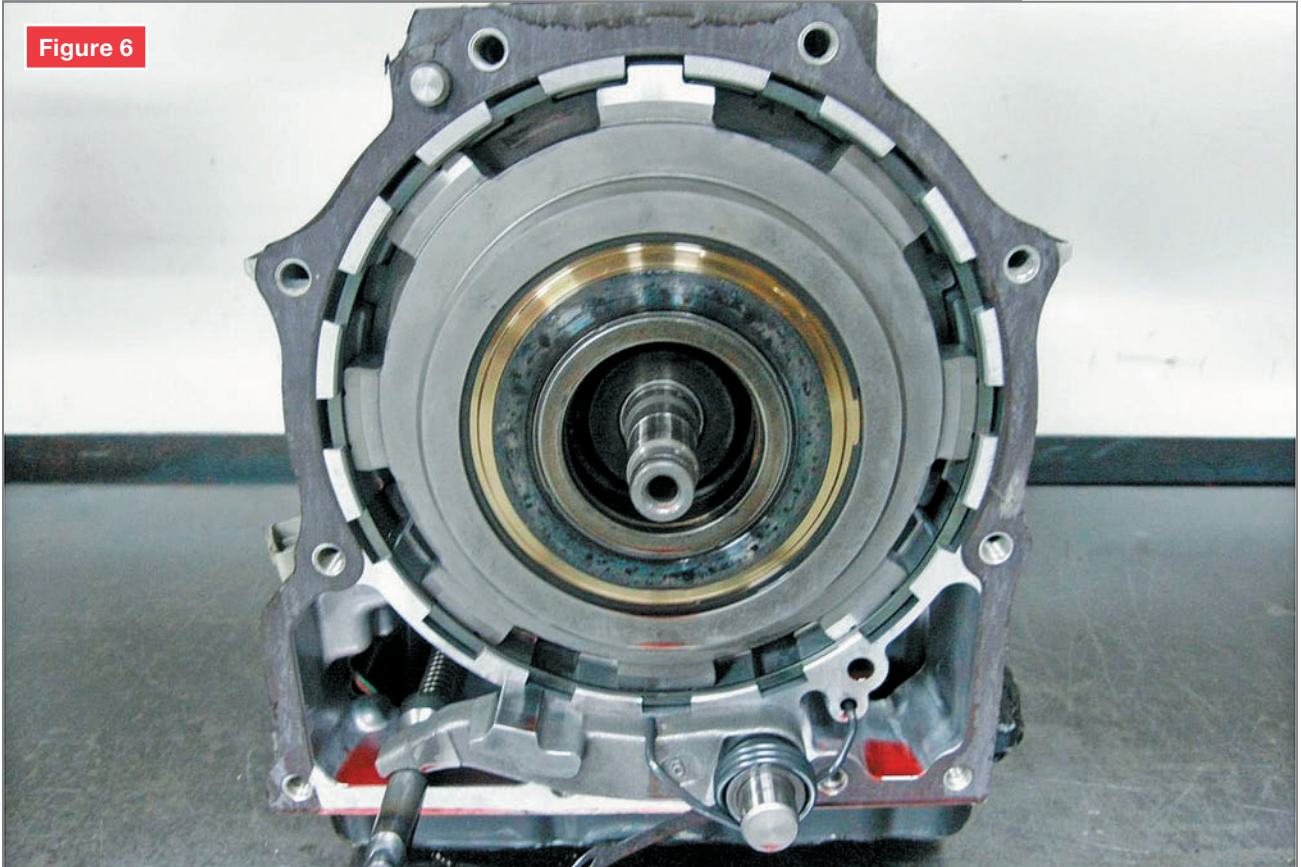


Figure 7



Figure 8

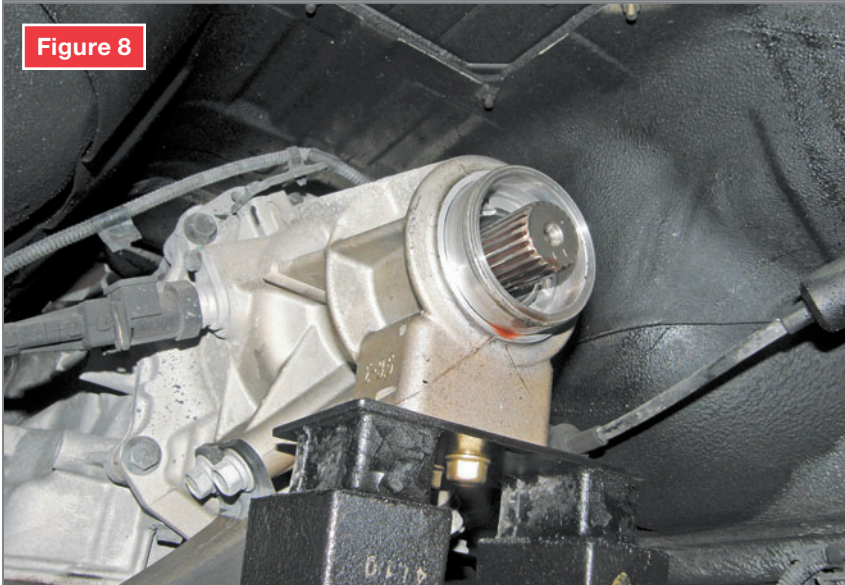


Figure 9



# No one has more.

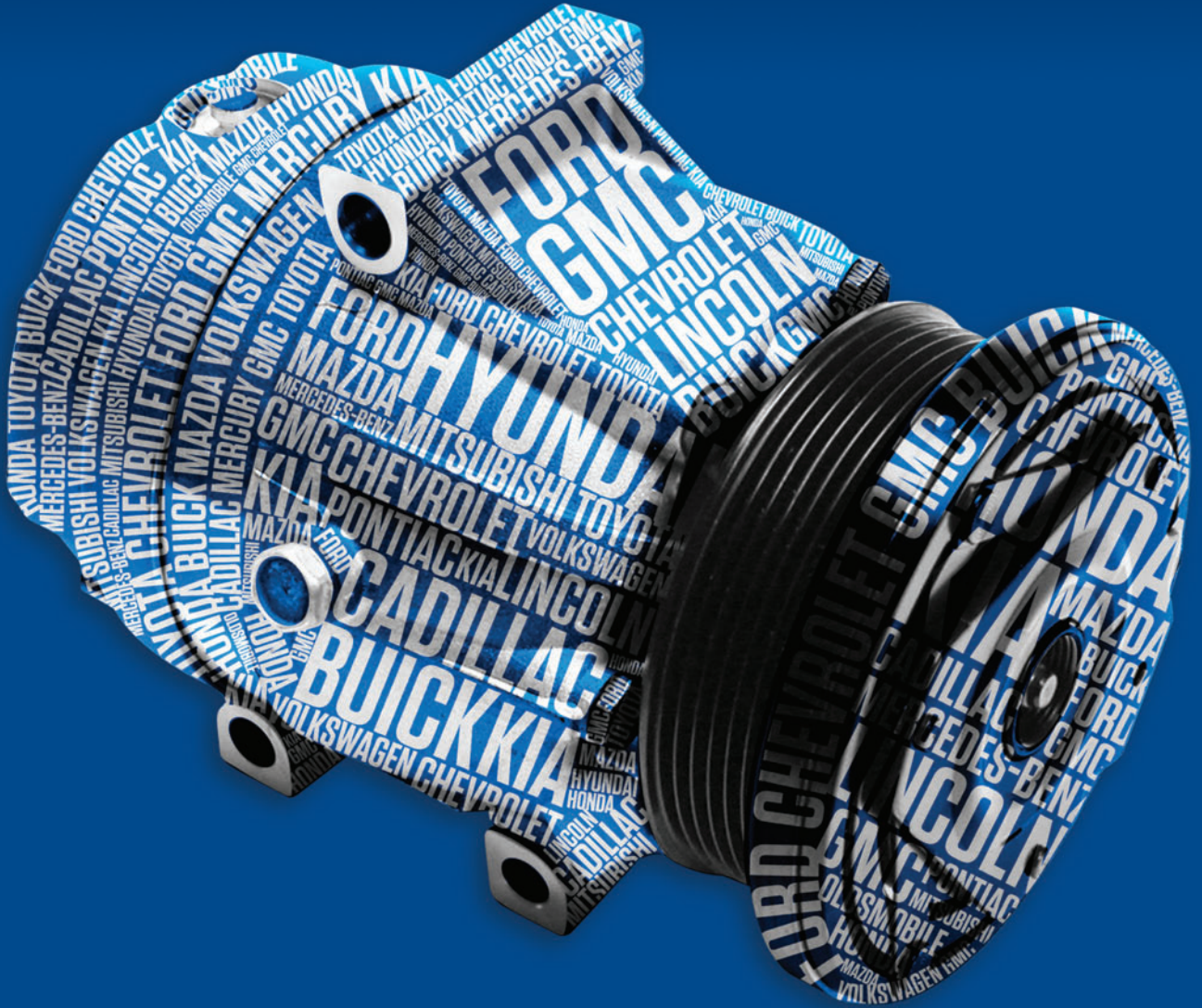


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output shaft ring breaks, it can allow clutch feed pressure to enter the lube circuit. This will cause a drop in clutch

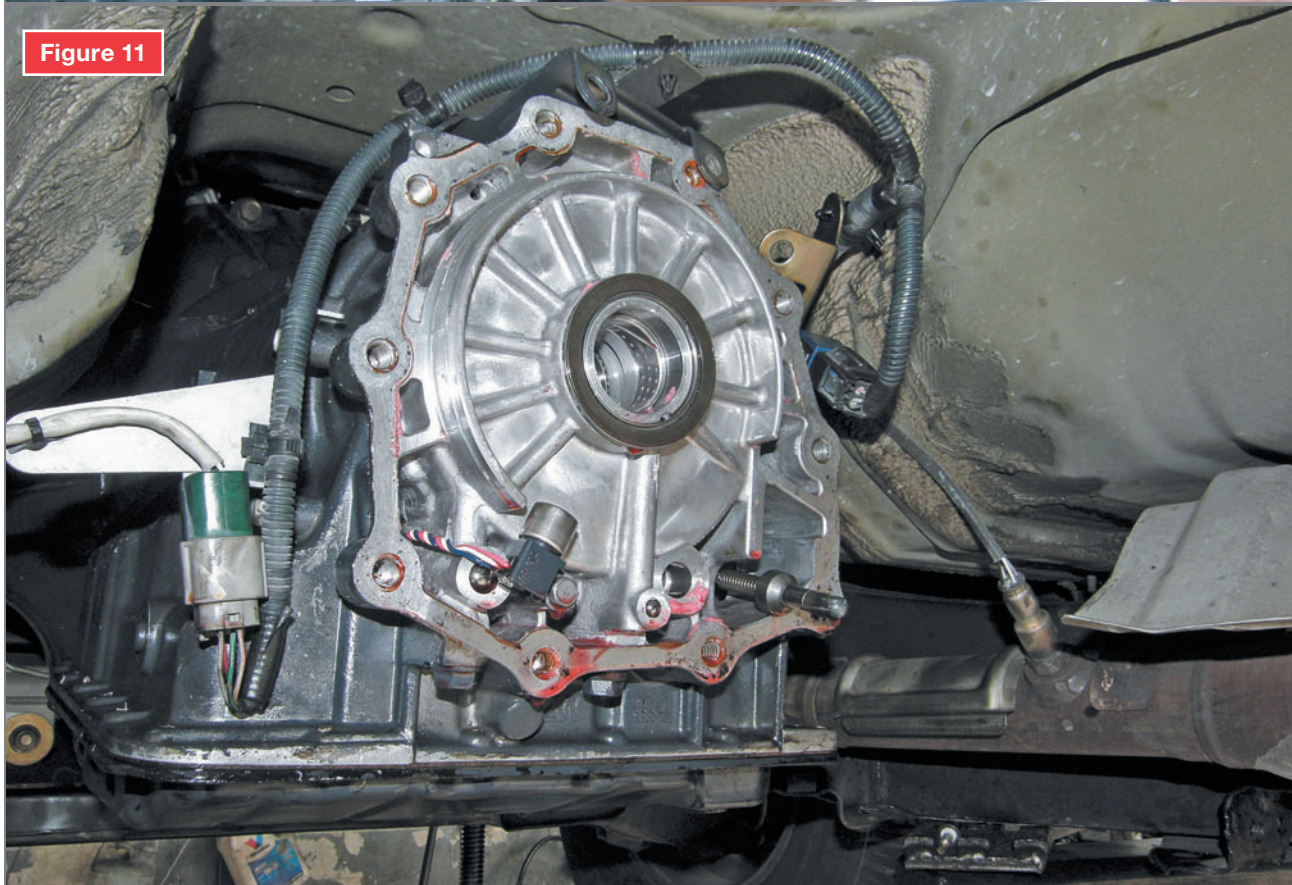
apply pressure — affecting drive and reverse engagements — and will burn the clutch.

If only an output shaft ring is broken, this can be repaired without pulling the transmission. The drive shaft or

Figure 10



Figure 11





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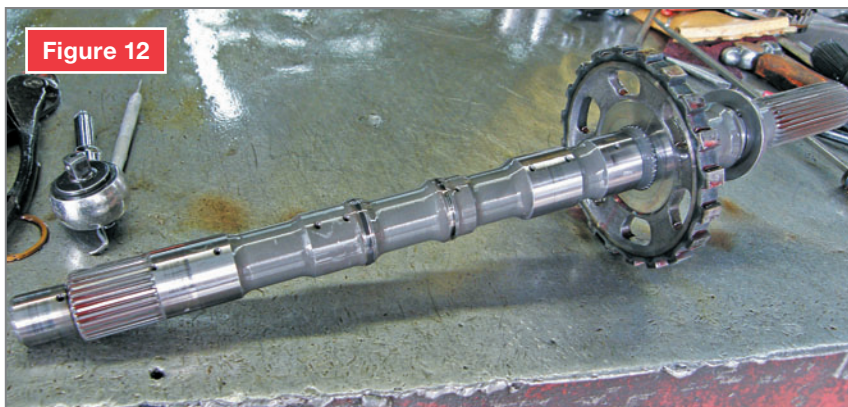


Figure 12



Figure 13



Figure 15



Figure 14

transfer case will need to be removed followed by the extension housing or 4WD adapter housing (Figures 7-9).

The drive shaft or transfer case holds the output shaft into place. Once it is removed, the parking gear and output shaft slides out of the transmission (Figures 10-12).

Once on the bench, the broken ring can be located and replaced with a new one (Figures 13-15). **TZ**



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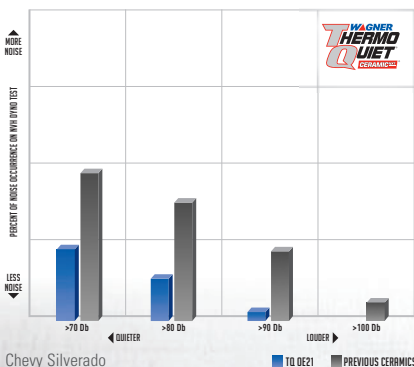
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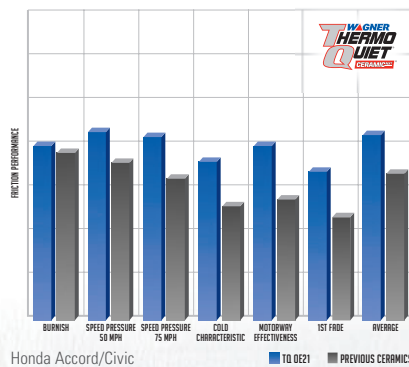


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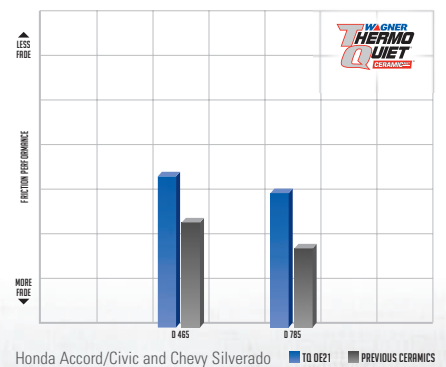
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## HYBRID AIR CONDITIONING SYSTEMS PRESENT SOME UNIQUE CHALLENGES. IS YOUR SHOP EQUIPPED TO HANDLE THEM?

BY **DAVE MACHOLZ** | CONTRIBUTING EDITOR

**H**ave you looked under the hood of a hybrid vehicle lately? If you have, then you already are familiar with the fact that there no longer is a serpentine-style drive belt to turn the accessories. Perhaps you have seen the advertisements that on some models of hybrid vehicles you can control the climate control system from your smartphone. Things definitely are changing.

Hybrid vehicles have pushed engineers to rethink the way they design A/C systems. While they maintain many of the same components that we are familiar with, quite a few new components and diagnostic procedures have emerged. Traditional testing methods might not apply to hybrid A/C system diagnosis, and we as technicians need to get up to speed

to keep pace with technology. In this article, we will take a look at hybrid A/C technology — and discuss repair and diagnostic strategies so you are well prepared when a hybrid A/C job comes through your bay doors.

### A look at the differences

One of the major component differences in hybrid A/C systems is the design and control of the compressor. Early hybrids, such as the first-generation Toyota Prius, had a belt-driven A/C compressor. The strategy here was simple: If you turned the A/C on, then the engine had to run.

The compressor turned at a rate of speed determined by the engine speed and compressor clutch engagement, no different from traditional A/C systems. This worked well, but the mpg

rating suffered considerably anytime the A/C was on.

With high demands on manufacturers to raise the mpg rate and improve battery life, unnecessary loads on the engine had to be removed. The problem this presents is that a belt-driven compressor cannot meet the need for A/C, especially if the engine is turned off.

Honda's early hybrid A/C compressor choice was a dual scroll-style compressor that used two separate drive methods: a belt and an alternating current (AC) electric motor, each with its own scroll. The strategy here was that anytime the vehicle went into idle stop mode (engine turned off), the electric side would take over to continue to provide climate control for the passengers.

In partnership with Denso, Toyota took the technology to a new level and



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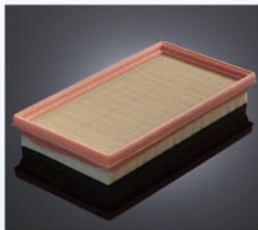
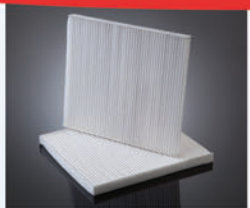
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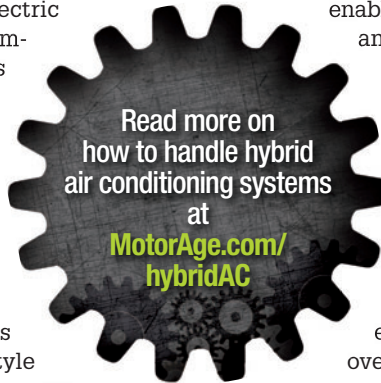
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age A/C from the  
inverter, but in  
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Toyota hybrids,  
the compressor  
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have adopted this style  
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The use of an electric compressor has

enabled engineers to design  
an efficient strategy for  
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vary compressor rpm  
based on commands  
from the HVAC elec-  
tronic control unit  
(ECU). With the use  
of a high-voltage  
(HV) compressor, how-  
ever, safety must not be  
overlooked. In many cases,  
as much as 200 to 300 volts

may be present. We will talk more  
about service and safety shortly.

Parameter	Value	Unit	Parameter	Value	Unit
Room Temperature Sensor	65.65	F	Foot/DEF Auto Mode	ON	
Ambient Temp Sensor	61.98	F	Foot/DEF Auto Blow Up	ON	
Adjusted Ambient Temp	57.78	F	Ambient Temperature Shift	Normal	
Evaporator Fan Thermostat	50.99	F	Purifier Auto Cancel	ON	
Evaporator Target Temp	38.60	F	Rear F/DEF Shut Switch	ON	
Solar Sensor (D Side)	0		Compressor Drive Check	OK	
Solar Sensor (P Side)	0		Number of Trouble Codes	0	
Engine Coolant Temp	69.62	F			
Set Temperature (D Side)	74.8	F			
Set Temperature (P Side)	74.8	F			
Blower Motor Speed Level	0				
Regulator Pressure Sensor	78.82	psig(gg w)			
Humidity Sensor	19.61	%			
Air Mix Servo Targ Pulse(D)	5				
Air Mix Servo Actual Pulse(D)	5				
Air Mix Servo Targ Pulse(P)	93				
Air Mix Servo Actual Pulse(P)	93				
Air Outlet Servo Pulse (D)	18				
Air Outlet Servo Acta Pulse(D)	18				
Air Inlet Damper Targ Pulse	7				
Air Inlet Damper Actual Pulse	7				
Compressor Speed	900	rpm			
Compressor Target Speed	1000	rpm			
Shift Sol Temperature	Normal				
Air Inlet Mode	Auto				
Compressor Mode	Auto				
Noise and Vibration Reduction	OFF				
ECO MODE Cancel	OFF				
ECO Switch	OFF				

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A high-voltage A/C compressor is identifiable by the orange wire loom.

Photo: Denso

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### The other features

To further improve fuel economy, manufacturers have developed several other ancillary technologies that are used in hybrid A/C systems. These ancillary devices have made for quite an improvement in overall air conditioning system efficiency — and you can expect to be seeing them in non-hybrid applications as well. To improve efficiency, the engineers had to find ways to ease the work-



This is an Ejector Cycle Evaporator.

load on the compressor, as it is the main consumer of energy.

One component they looked to change was the condenser. As with all A/C systems, the gaseous refrigerant leaves the compressor and enters the condenser, where a heat exchange occurs to transfer heat from inside the cabin to the outside air. In doing so, the refrigerant cools and condenses, or turns to a liquid. This works well for the most part, but not all of the gas content is condensed in traditional condensers.

New condenser designs re-circulate the gaseous refrigerant before it leaves the outlet of the condenser so that it can be turned to a liquid. The result here is a much more efficient condenser. You will see these referred to as “high-efficiency” or “sub-cool” condensers. Once the liquid refrigerant leaves the condenser and passes through the receiver drier, we need to drop the pressure and temperature of the liquid refrigerant.

To accomplish this, we historically have used thermal expansion valves, or TXVs. The expansion valve was designed to reduce the pressure and temperature of the liquid refrigerant before it entered the evaporator.

The expansion valve worked well, but from a performance perspective

it was highly inefficient. What takes place in the expansion valve is a sudden pressure drop where the diameter of the valve goes from small to large, which significantly lowers the pressure and temperature of the refrigerant as it enters the evaporator. One downfall of the TXV, then, is the development of turbulence in the area of the pressure drop. To overcome this turbulence, the compressor simply has to work harder. To eliminate this inefficiency, Denso has developed a new evaporator called an ejector cycle evaporator.

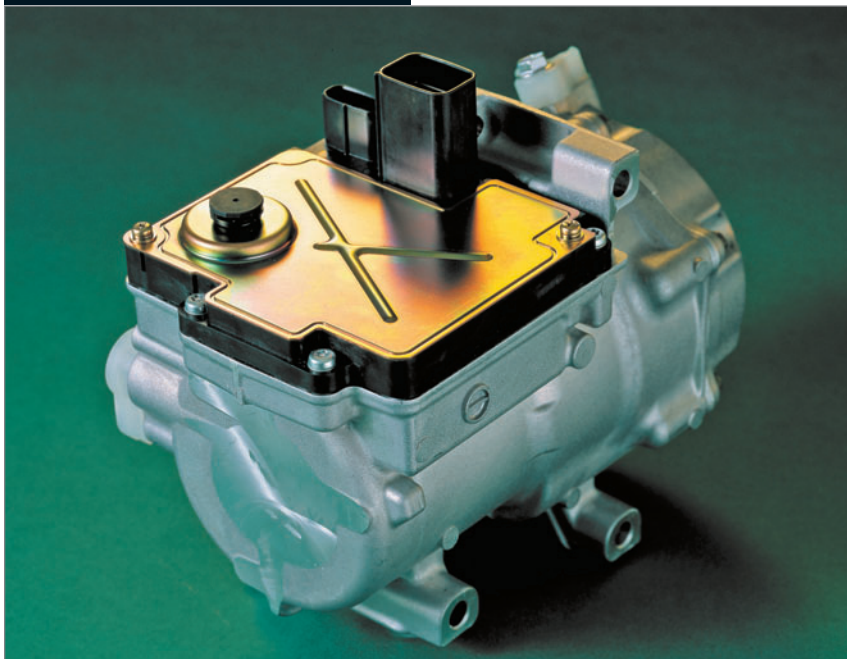
Denso first developed ejector technology for the refrigeration and truck

**Don't be fooled by a vehicle that has a belt on the compressor. Vehicles such as the Honda Civic hybrid might have a belt on the front of the compressor, but a high-voltage wire harness routed so that you might not see it at first. Be careful.**

market in 2003. The initial version of the ejector was quite large, but after six years of research, Denso was able to make it small enough so that it could be manufactured as part of the evaporator for the 2010 Prius.

The ejector cycle evaporator eliminates the TXV and improves overall system efficiency by recovering the energy that is created as a result of expansion. The ejector is similar to the TXV, but re-circulates refrigerant cooled in the evaporator back into the inlet area of the evaporator through a venturi — much in the same manner in which old, small engine venturi carburetors functioned. This venturi effect increases the velocity of the refrigerant, and eliminates energy losses while achieving the same cooling effect as the TXV.

The velocity that is developed by the ejector also raises the inlet pressure at the compressor, which means its compression ratio can be lowered



HV compressor with integral DC to A/C inverter.

Photos: Denso



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to improve overall system efficiency. Denso claims that the system performance improvement is 50 percent at 64.4 degrees Fahrenheit — a considerable gain.

Coordination of these new technologies is typically done by a dedicated ECU. This is not a new concept, as manufacturers have been using dedicated HVAC ECUs for some time now. The main difference in control of hybrid A/C systems is that the hybrid battery

and inverter, not the engine, is powering the compressor. This means that the A/C ECU and the power management or inverter ECU will have to communicate.

Knowledge of CAN and LIN communication systems is a must for diagnosis should a problem on the communication network, or bus, occur. The benefit to having these ECUs is system access via the scan tool. The downfall is that if your scan tool doesn't support the Parameter Identifiers (PIDs), you might not be able to diagnose the vehicle.

### The repair itself

Now that we have an overview of hybrid A/C system operation, we can dive into the service and repair issues you might face. You might need to invest in some tooling to get the job done, and as with any technology, hands-on training is highly recommended.

Toyota does not allow its service techs to work on hybrid A/C systems unless they have passed six days of hybrid hands-on training. You might want to consider taking similar measures at your facility. Mistakes on a hybrid A/C system can be rather costly, so proceed with caution.

**Safety** — As with any other hybrid-related repair, you need to proceed with caution and adhere to the manufacturer's recommended safety procedures at all times. HV components typically are easy to identify by their bright safety-orange wire looms.

Don't be fooled by a vehicle that has a belt on the compressor. Vehicles such as the Honda Civic hybrid might have a belt on the front of the compressor, but an HV wire harness routed so that you might not see it at first. Be careful.

Whenever working on an HV component, you will have to shut down the HV system. Follow service information instructions to the letter. If you should decide to unplug an HV compressor while the system is powered up, you not only will destroy the connector on the compressor, but you also will run the risk of serious injury, and even death. The connectors on electric compressors are not serviceable and come as part of the compressor assembly. Keep in mind, however, that even though this is a HV system, you most likely won't be doing much high-voltage work unless a compressor fails or there is an insulation fault somewhere.

**Refrigerant and refrigerant oils** — Hybrid A/C systems call for R-134a refrigerant and require POE oil, not PAG oil. There are several reasons for this. Nippon-Denso's POE oil, known as ND-11, is used in many of the hybrid A/C compressors and has a high insulation value, just more than 10 megaohms (10 million ohms). ND-8, which is a PAG oil, has an insulation value of less than 1 megaohm — a considerable difference.

Hybrid manufacturers state that it is



An insulation tester such as the Fluke 1587 may be necessary to diagnose HV insulation faults.



(Left) A cutaway look at the ejector. (Right) The orange HV cable to the A/C compressor on this current-generation Toyota Hybrid has high-voltage DC sent to the compressor where it is inverted to A/C to drive the motor.

Photo: Fluke

Photo: Denso

Photo: Toyota



The second-generation Prius inverters have a built-in inverter for the compressor, while the third generation has the inverter in the compressor. Notice the three-phase cable on the early inverter.

unacceptable to use even the slightest amount of PAG oil in these systems. Denso has claimed that just 1 percent of PAG oil introduced into the system can lower the insulation value of the overall system charge to less than 1 megaohm.

The issue at hand here is that if a short from the HV windings in the electric compressor should occur, it might cause an unsafe condition. Another scenario that has happened to a few Toyota dealers was when the dealer had replaced a component and charged the system with PAG oil. The result was HV insulation diagnostic trouble codes.

Manufacturers run a voltage detection circuit on all of their HV components to monitor HV insulation leaks, and the slightest change in voltage can set codes and disable the hybrid system. It was determined that the use of the wrong oil caused these codes to occur. This has prompted Toyota — as well as other manufacturers — to recommend the use of a dedicated A/C machine for hybrid A/C service.

GM has its own service bulletin that recommends using a hose flush between charges to eliminate any traces of PAG from the lines on their A/C machines. It claims that PAG oil contains some moisture that could possibly degrade the insulation of the HV windings, resulting in a dangerous situation and diagnostic trouble codes (DTCs).

If you are using the Robinair ACR-2000, you can pick up the hose flush adapter kit from Kent Moore (Part No. J-43600-50) pretty inexpensively. If you are planning on doing some hybrid A/C work, look into what the equipment manufacturers are recommending for the machines you own and get yourself a good filter and flushing mechanism. Remember, when it comes to refrigerant service on hybrids, cross-contamination is the enemy.

**System diagnosis** — Since the beginning of A/C system service, one preferred method of diagnosis was to hook up a set of manifold gauges to the high- and low-side service ports and see what you've got. That pretty much has gone the way of the dodo on hybrid vehicles. Not only can pressure readings be unreliable, but you might run the risk of cross-contamination by hooking up your old R-134 gauges.

The majority of diagnosis on hybrid vehicles is going to

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be done with a scan tool. It might be a good idea to have a look at the PIDs and active tests available on your scan tool platform on a known good car before you attempt to use your tool on a broken car.

If your aftermarket scan tool isn't up to the challenge, it might be time to think about factory tooling. The factory tools give you all the PIDs you need, as well as active tests for the

compressor, which can make the difference between fixing the car and losing it to the dealer.

Play with your scan tool on a known good hybrid the next time one is in your shop. You might be surprised to see the available active tests that can help you get a diagnosis quickly.

Factory scan tools allow you to command the compressor to a desired speed and watch the rpm to determine that it has achieved the command. This might come in handy before condemning an expensive compressor.



Some hybrid HV A/C controls look identical to their non-hybrid counterparts.



The ability to remotely turn on the A/C system from your smartphone is a convenient feature on some new hybrids.

**Insulation fault diagnosis** — You might already have been in a situation where the hybrid system warning light is illuminated and the vehicle doesn't ready on. As we mentioned earlier, this could be something as simple as someone installing the wrong refrigerant oil. The manufacturers have gone to great lengths to provide DTCs, as well as information sub codes, to point you in the right diagnostic direction.

Should the problem lie in the HV compressor, you will need to perform a test of the windings and the wiring from the inverter to the compressor. To do this, you will need to have a good insulation tester. Take a look at the January 2014 *Motor Age* article by Jerry "G" Truglia for some great tips on using a "Megger."

Now that you have some information on hybrid A/C, it's time to do your homework. Attend some training on hybrid A/C, and explore the capabilities of your scan tool the next time a hybrid vehicle comes in for service. With an open mind and some new knowledge, you can now offer hybrid A/C service to your hybrid customers with confidence. **TA**



**DAVE MACHOLZ**  
CONTRIBUTING EDITOR

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

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# KEEP THE 'COOL' IN COOLING SYSTEMS

A major cause of a brown looking rust in a DEX-COOL® vehicle's cooling system also can be the reaction of the coolant and casting sand left over from the manufacturing process.

## COOLING SYSTEM SERVICE FUNDAMENTALS ARE UNCHANGING, BUT THE DETAILS — AH, THE DETAILS.

BY DAVE HOBBS | CONTRIBUTING EDITOR

**C**hanges in technology for the “David and Goliath” extremes of engines used in both hybrid passenger cars and light-duty diesel trucks definitely will ruin your day if you don't know how they operate. Assuming all coolants are created equal can ruin your day as well. But the encouraging news is there's good money to be made in cooling system repairs.

While oil change and spark plug replacement intervals have gone up over the years, surveys indicate 35

percent of vehicles inspections reveal an improper coolant level, improper coolant mixture or coolant leaks. All of this gives you the green light to sell proper cooling system maintenance and repairs to your customers.

### Coolant basics

The center focus on cooling systems always has been the coolant itself. Do you have enough coolant in the system? Are there leaks? What is the freeze protection? Is the coolant in good condition? Those used to be about the

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only questions regarding coolant, but times have changed.

Generally speaking, ethylene glycol has around 3 percent additives present to prevent corrosion, control pH levels and add color to the coolant. Added to the coolant is, of course, water, which averages around 50 percent of the coolant mix.

Most of us have seen the charts giving a clear picture of the ratio of the concentration of antifreeze vs. water

Photos: Dave Hobbs

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in coolant. As antifreeze concentration goes up, the temperature protection goes up with it until that concentration goes past the 70 percent mark, where the freeze protection is actually reduced.

Testing has been simple, with a hydrometer that checks the specific gravity (and freeze point) of coolant. Hydrometers are cheap — some even fit in your pocket. But cheap can some-

times be expensive. Laboratory studies indicate that hydrometers can be as much as 23 degrees Fahrenheit off in their measurements for freeze protection.

In recent years, the refractometer has become more popular because it's more accurate (within 1 degree Fahrenheit) and dependable for testing coolant strength to ensure ample freeze protection. They are also com-

patible for testing both ethylene glycol (EG) and propylene glycol (PG), while the hydrometer measures either one or the other.

## EG vs. PG

Speaking of propylene glycol, did you know no OEM vehicle manufacturer recommends it? That is why you will see it only in the aftermarket. It's more expensive, too, so why has it ever sold?

Unlike EG, PG is biodegradable — and safer for pets regarding accidental poisoning. This benefit is not because it is less toxic, but rather, it is less sweet to the taste. If your dog or cat doesn't like it, they are less inclined to drink it.

PG is sold by Peak under the brand name Sierra, and by AMSOIL. EG is required in more than a dozen states to contain a bittering agent called denatonium benzoate to prevent accidental pet poisoning.

## Leaking systems

When a cooling system leaks, air replaces the leaked out coolant. The reaction between DEX-COOL and air creates a rusty brown substance that clogs up various components and passages in the system. Regarding air intrusions, keep in mind coolant leaks aren't always onto the ground or into the combustion chamber via a bad head gasket. Radiator caps have two seals. One seals and allows the radiator to expel high temperature/high-pressure coolant into the reservoir. The other allows vacuum created by a radiator that is cooling back down to pull coolant back from the reservoir.

If the reservoir is empty, the hose between it and the radiator is not sealed or the cap is bad, air entering into the radiator can be the result. Caps are cheap-enough and easy-enough fixes. Test and replace — or just replace.

On the subject of head gaskets, leaks are not always easy to find with a compression gauge or cylinder leak tester. Using a combustion leak detector in the coolant works well, and can be tested by moving it to the exhaust pipe while the engine is running. Another valuable tech tip is to remove the radiator cap (engine cold) while performing a cylinder leak down test on each cylinder at TDC compression. If you see the

## COOLANT CHEMISTRY

Even within the ethylene glycol (EG) family of coolants, there are a fair amount of differences. The original green EG antifreeze many of us grew up with is now obsolete. Green in color, it went by the name Inorganic Additive Technology (IAT). It contained borates, phosphates and silicates, the last of which could drop out of the mix and become abrasive.

When cavitation occurred because of low levels in the systems and sharp bends in the cooling system were present, the velocity of the silicates in the coolant could, at times, cause rapid repeat component failures. It was not unheard of to see a new heater core begin leaking in just a few hours — as the abrasive nature of the silicates works as a sandblaster when the aforementioned conditions occurred.

When changed regularly, IAT has good corrosion protection, but the additives that afford this benefit are consumed when maintenance is neglected. IAT also can cause early failures of ceramic-phenolic seals commonly utilized in more modern water pumps.

Organic acid technology (OAT), made popular by GM's DEX-COOL®, is the OEM coolant not only for GM, but also many Asian and European automakers. GM started with it in 1996 and deemed it a 5-year/150,000-mile coolant. While OAT gives a properly maintained vehicle a long life coolant thanks to longer-lasting additives, the older IAT and the newer OAT should never be mixed for one simple reason: Add some green to a late-model vehicle, and that orange long-life coolant no longer has the long-life characteristic.

Chrysler, Ford, Mercedes and some others recommend not using OAT / DEX-COOL coolant in their late-model vehicles. For those vehicles, a hybrid

organic acid technology (HOAT, a.k.a. G-05®) formula of EG is used. A visit to Zerex's website (or a look at the back of a gallon jug) will give you the scoop on which coolant is for what, along with a simple color coding of green for the old EG IAT (conventional short-life antifreeze), orange for OAT (GM DEX-COOL), and yellow for the HOAT EG.

Those are strictly the colors for Zerex, though. HOAT can come in blue, pink, orange and blue — and even green on some Chrysler products. While HOAT EG does contain some silicates, the amount is less than its predecessor; the old conventional green IAT OAT / GM DEX-COOL had a very rough road in the first few years.

OAT / DEX-COOL contains ethylhexanoic acid (2-EH) as a corrosive inhibitor. 2-EH is prone to damaging plastics like the Nylon 66 used in intake manifold gaskets and radiators. G30 OAT and Peak Global OAT do not use 2-EH. Besides 2-EH found in some OAT / DEX-COOL coolants, air was determined to be a major factor in causing system breakdowns.

If those formulas weren't enough, phosphated organic acid technology (POAT) came to market in 2008, for newer Mazda engines made for Ford. It's a dark green color.

Which coolant do you use? Which coolant *should* you use? If you have a trusted coolant supplier supplying you with a universal coolant that has long life, works well with any other coolant and has served you well for years, I will refrain from arguing that you change a practice that works. On the other hand, if you get a vehicle with repeat cooling system component failures, measured electrolysis, or major contamination/breakdown of coolant, go find the proper OEM-recommended factory coolant.



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coolant level begin to rise in the radiator, there is a leak near that cylinder in the head or head gasket.


## Electrolysis

When coolant is neglected, the chemical reactions can cause some interesting side effects. Besides rust and corrosion creating havoc on metals, hoses, plastics and gaskets, electrolysis can occur. There are two types of electrolysis:

- Type A is not caused by bad coolant, but rather bad electrical connections and grounds. Current for various electrical accessories on the vehicle takes a path through the coolant.

- Type B occurs because the acidic nature of the coolant and dissimilar metals in the cooling system create a makeshift galvanic battery in the cooling system.

Diagnosing electrolysis is easy. Using your DVOM, simply set your meter to DC volts and measure the voltage in the actual coolant. A voltage reading greater than 0.3 volt will accelerate the deterioration of an aluminum radiator or heater core. Check



An oldie, but a goodie: Watch The Trainer take on cooling system service at [MotorAge.com/sep12trainer](http://MotorAge.com/sep12trainer)

all ground circuits under the hood.

If you still haven't resolved the voltage problem, remove one fuse at a time until voltage drops, and verify that specific circuit. Type B electrolysis will produce a more acidic nature within the coolant, so in addition to the voltage test, use inexpensive pH strips to test the pH level of the coolant. Generally, any pH level below seven is considered acidic.

Regardless of whether the electrolysis is Type A or B, the coolant must be flushed and replaced — thanks to the aluminum corrosion inhibitors being destroyed.

## Corrosion

Corrosion is a form of rust that produces aluminum oxide. It appears in the form of a white powder-like coating, accompanied by metal surfaces of the cooling system literally being eaten away. The classic example would be aluminum gooseneck thermostat housings, to where the upper radiator seals.

Besides creating leaks in some situations, the aluminum oxide/corrosion



With the engine off, connect the negative meter lead to the negative post of the battery. Submerge the positive meter lead in the coolant, touching only the coolant and not any metal in the radiator. First test with the engine off, then start the engine and observe while cranking and with the engine running. IMAGE: MACS Worldwide



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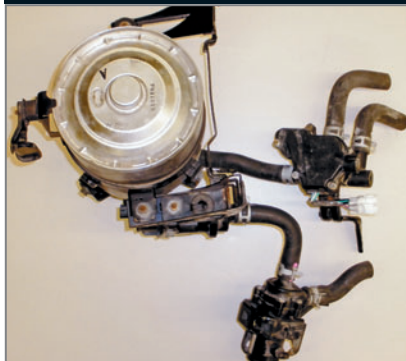
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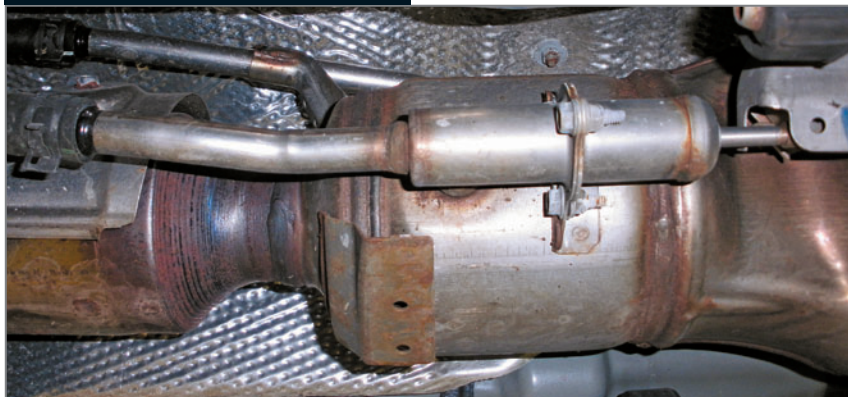
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There is a radiator air bleed with an access hole hidden by a plastic radiator support beauty cover. A factory tech tip on this car is to use your scan tool to turn on the auxiliary coolant pump that supplements the belt driver water pump with engine coolant circulation duties as a way of helping burp air out of the system during refills.



The system in place has a complicated set of pumps, electric valves, hoses, sensors and, of course, the metal (thermos) heat storage tank.



Gen III Prius also does away with the heat storage tank, but attacks early engine start HC production with a special HC absorber chamber in the catalytic converter; it is physically actuated via warm coolant routed to an actuator on the side of the cat.

reduces the heat transfer ability of the coolant to get rid of heat in the engine. This is because it provides an insulation effect on the metals it covers.

## Cavitation

Cavitation is the sudden formation and collapse of low-pressure bubbles. With gasoline engines, the pressure drop can occur at the inlet of the water pump. These bubbles produce a pitting of the solid metal. Occasionally, a manufacturer will release a redesigned water pump via a Technical Service Bulletin (TSB) to address cavitation issues that were not discovered during vehicle design and validation.

## Filling the system

Approximately 15 percent to 20 percent of the coolant in the system stays in the system. If the radiator cap and overflow hoses are sealing good, the overflow reservoir should empty during a radiator drain plug pull. But you'll still have some coolant in the block, even if the block drains are pulled.

If you don't purchase pre-mix, be sure to avoid using tap water. Some vehicles will even have a "No Tap Water" sticker under the hood. Tap water will vary from community to community and, of course, well water is rich in trouble-inducing minerals. Distilled water contains fewer minerals, so make sure you keep it in your shop in ample supply.

Because of cavitation issues, you want all the air out of a system. That can be done several ways, with some more effective than others. The obvi-

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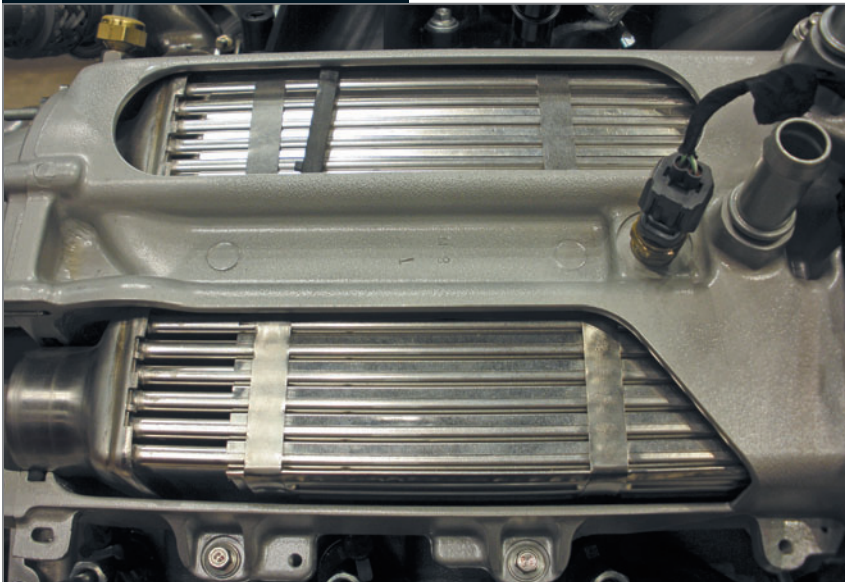
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GM's Chevrolet Volt extended range EV (a hybrid of sorts also) requires a special premix DEX-COOL® containing deionized water (nonconductive) for that vehicle.



The belt-driven pump is one of the few weak links on the Gen II Prius. The pump's bearing tends to go out around 120,000 miles — and as it does so, it allows the bearing seal to leak and sometimes chew up the drive belt.



Both the primary and secondary cooling systems on Ford's 6.7L Powerstroke also cool the dual EGR coolers, as shown here in this cutaway.

ous air bleed screws and following the manufacturer's procedures are in order, but there are a couple of effective generic methods out there for a successful air-free fill:

- The funnel system uses radiator filler neck adapters, which allow a special funnel with a shut-off valve to be fastened to the radiator or pressurized degas/reservoir tank fill neck. You fill the radiator via the large funnel with coolant, then start the engine. This allows a thermal cycle to cause some expansion of the coolant in the radiator. The coolant expands into the large-volume funnel and as it does, air bubbles in the system come to the surface of the coolant in the funnel.

Remember, coolant can take away heat from a water-cooled engine, but air pockets can't. Air pockets can't provide sufficient heat to the passengers via the heater core, nor can they give an Engine Coolant Temperature (ECT) sensor an accurate reading. Air pockets can even give a false diagnosis for a faulty head gasket.

- The alternative to the refill funnel is an air lift system. Using shop air to create a venturi-created vacuum, these inexpensive tools are excellent at getting an air-free fill. Like an A/C vacuum pump, remove the supply of vacuum (pull off the shop air) and look to see whether the vacuum decays. If it doesn't, large leaks are not likely.

Now with a fill hose primed with coolant, twist the valve on the air lift unit to allow the primed hose — sticking down into a container of coolant — to pull the coolant into the system. The whole process takes only seconds.

## David and Goliath engines

Middle-of-the-road engines have had a few innovations in cooling and heating systems in recent years, such as electric auxiliary water pumps to move coolant into the heater core for better cold temperature/idle heater performance. But there is nothing newer and more complicated than the cooling systems on Toyota Prius and Ford Powerstroke diesels. When you raise the hood on either of these vehicles, you might feel a bit intimidated unless you've had some training and experience.

## Toyota Prius cooling

The Prius was a single-mission vehicle: It's always been a hybrid electric vehicle and nothing else. Part of that hybrid mission is superior fuel economy, and the other part is getting that Advanced Technology Partial Zero Emission Vehicle (AT-PZEV) rating. One feature which helps to achieve the AT-PZEV is a special cooling system that lowers hydrocarbon (HC) emissions during cold starts.

Generation II Prius vehicles (2004-2009) do so by sending hot coolant from an air/vacuum insulated hot coolant (thermos) storage tank into the cylinder head. Mounted in the left front inner fender, this tank — quite often damaged in minor frontal collisions — can keep coolant at operating temperatures for more than 24 hours. That's a good thing to know when you are draining it (the heat storage tank is the lowest point in the cooling system) and not expecting to be burned by hot coolant after the car has sat overnight at your shop.

Keep in mind on this generation of Prius, the bottom quarter of the radiator is separate from the top and used for coolant to cool the inverter, converter and transmission mounted motor/generators, so the radiator petcock will be about 4 inches from the bottom of the radiator. When the gas engine is in idle stop mode, the auxiliary water pump keeps the heater core filled with hot coolant on those cold winter mornings.

In addition to the belt-driven pump and auxiliary electric water pump, there is another electric pump for engine coolant just for this early-start HC emission reduction feature. It runs to regularly keep the heat storage tank with hot coolant — and, of course, to pump the hot coolant to the engine on cold starts. You always should hear that pump run for a couple of seconds whenever you switch off the main power button. A fourth pump (three electric and one mechanical) is under the hood. It is solely there to move coolant in a totally separate cooling system that keeps the high-voltage electronics cool. Even though that system is separate from the gas engine's system, they both use the same Toyota coolant. Make sure you use that coolant, too. When cooling electronics that have hundreds of volts and amps, you don't want to take chances on creating corrosion.

Also on the Prius, make sure you know which pump is where, and that you are able to describe what you want to your parts person when ordering a "water pump." Generation III Prius (2010 and newer) did away with the weak link mechanical water pump in lieu of a 12-volt electric model, which negated the need for an auxiliary engine coolant pump. Gen III Prius also does away with the heat storage tank, but attacks early engine start HC production with a special HC absorber chamber in the catalytic converter — it is physically actuated via warm coolant routed to an actuator on the side of the cat.

### Ford Powerstroke cooling

Those who work on these on a regular basis appreciate all the complexities and service "opportunities" this engine provides, especially the 6.0 models. Ford uses engine oil that is greatly pressurized to operate its fuel injectors. As with all diesels that make tons of NOx emissions, an EGR valve is in place to cool the combustion chamber down during the power stroke. To make the EGR action more efficient, there are one or more EGR coolers that use engine coolant to cool the cooler(s) down.

Engine coolant also is used to cool the engine oil reservoir in place to manage the high-pressure oil system in place to assist with HP direct fuel injection. That's asking the oil to do a lot,

and the engine coolant to do even more.

One frequent failure item is the EGR cooler. When it leaks, you can get coolant in the exhaust (white smoke) or in the crankcase. Simply replacing the EGR cooler is often not the complete answer. Understanding the flow of air, oil and coolant on any diesel is very important.

In the case of Powerstrokes, the oil reservoir that supplies the oil assisting in HP fuel pressurization gets the engine coolant before the EGR gets it. When the oil is hot because of poor maintenance or the engine has been "chipped" to have more horsepower, the coolant will be hotter than normal before it hits the EGR cooler. By all means, replace the leaky EGR cooler — but also look into the other factors that made the coolant hot enough to begin with, such as the coolant passageways in the oil pump reservoir.

Casting sand has been a problem with these Ford diesels, as has air cavitation, but an even bigger problem has been the use of tap water and non-recommended coolants containing silicates. When serving the newer 6.7 Ford Powerstrokes, anyone servicing the cooling system will be in for a real shock. There are two complete cooling systems: one for the engine and heating the heater core; the other one for cooling the fuel conditioner and transmission cooler. Both systems have their own water pumps, radiators and dual thermostats, which are located in each radiator and on the engine.

The Prius and the Powerstroke truly are examples of where cooling systems have taken a quantum leap in complexity — and that means we'll have to continue to keep up to date in order to keep our customers engines cool and heater cores warm. *ZZ*



**DAVE HOBBS**  
CONTRIBUTING EDITOR

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

Email Dave at [david.a.hobbs@delphi.com](mailto:david.a.hobbs@delphi.com)



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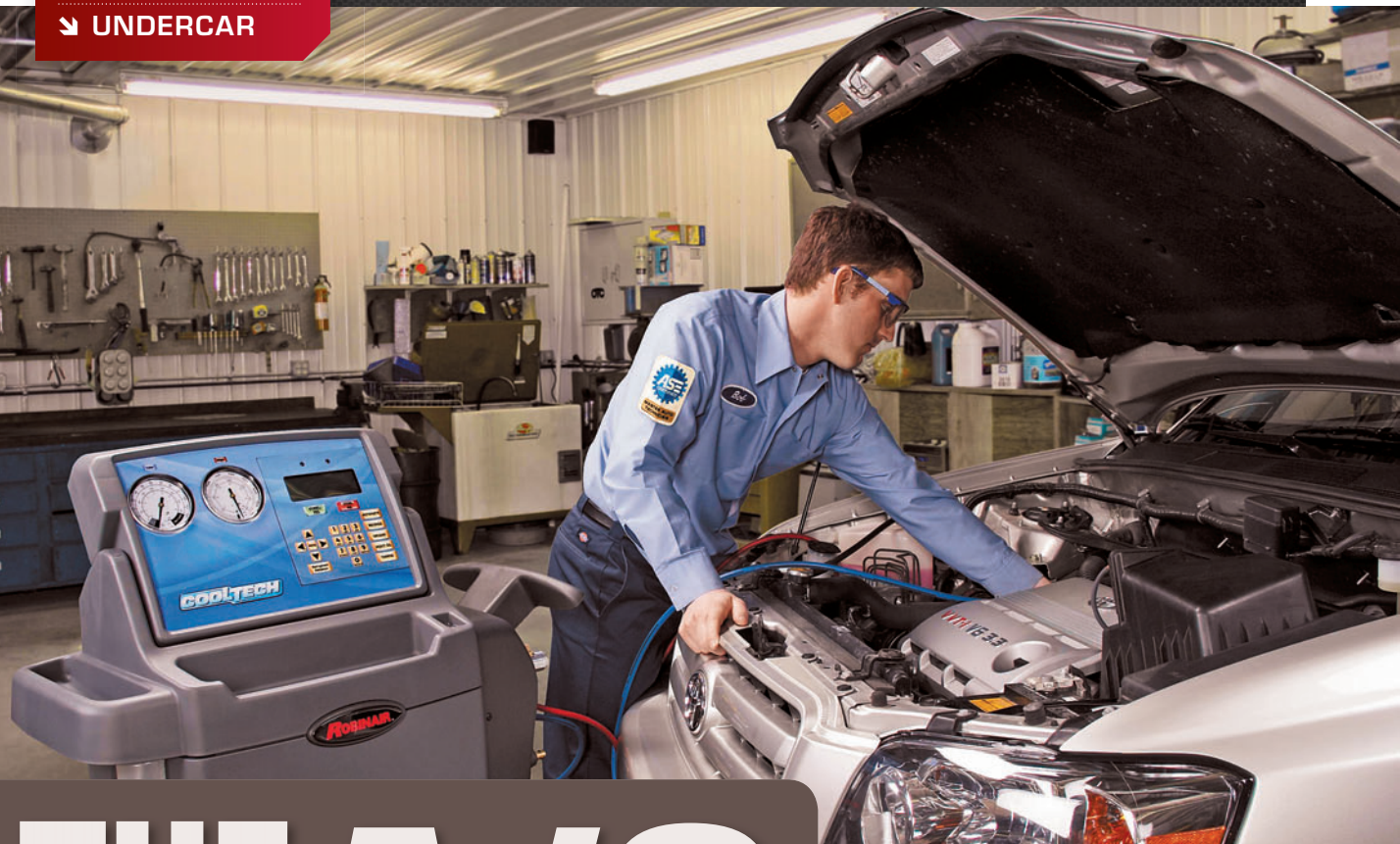
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## TECHNOLOGY

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# THE NEW A/C CHALLENGES

There are several challenges facing those in the A/C service and repair business. But we've overcome challenges before.

THE DAYS OF R134A ARE NEARING AN END. WHAT CHALLENGES WILL THAT BRING US?

BY **PETER F. MEIER** | TECHNICAL EDITOR

In early February, the U.S. Environmental Protection Agency (EPA) announced its plans to issue a proposed rule that would eliminate the use of R134a as a refrigerant in new motor vehicles and as an aerosol in many consumer products. According to the press release, this action is being taken in support of President Obama's Climate Action Plan, which aims to "develop an 'all-of-the-above' strategy for reducing emissions of greenhouse gases in the U.S."

I hate to say it, but I told you this was

coming almost 5 years ago in a blog post I wrote for our online community, the AutoPro Workshop.

What does this all mean for our industry? Will we see a repeat of the R12 phaseout many of us experienced firsthand? Will we be performing retrofits to older systems, and if so, with what?

To understand the future, we need to review a little history.

## Climate change and R134a

No matter your personal opinions on global warming and climate change,

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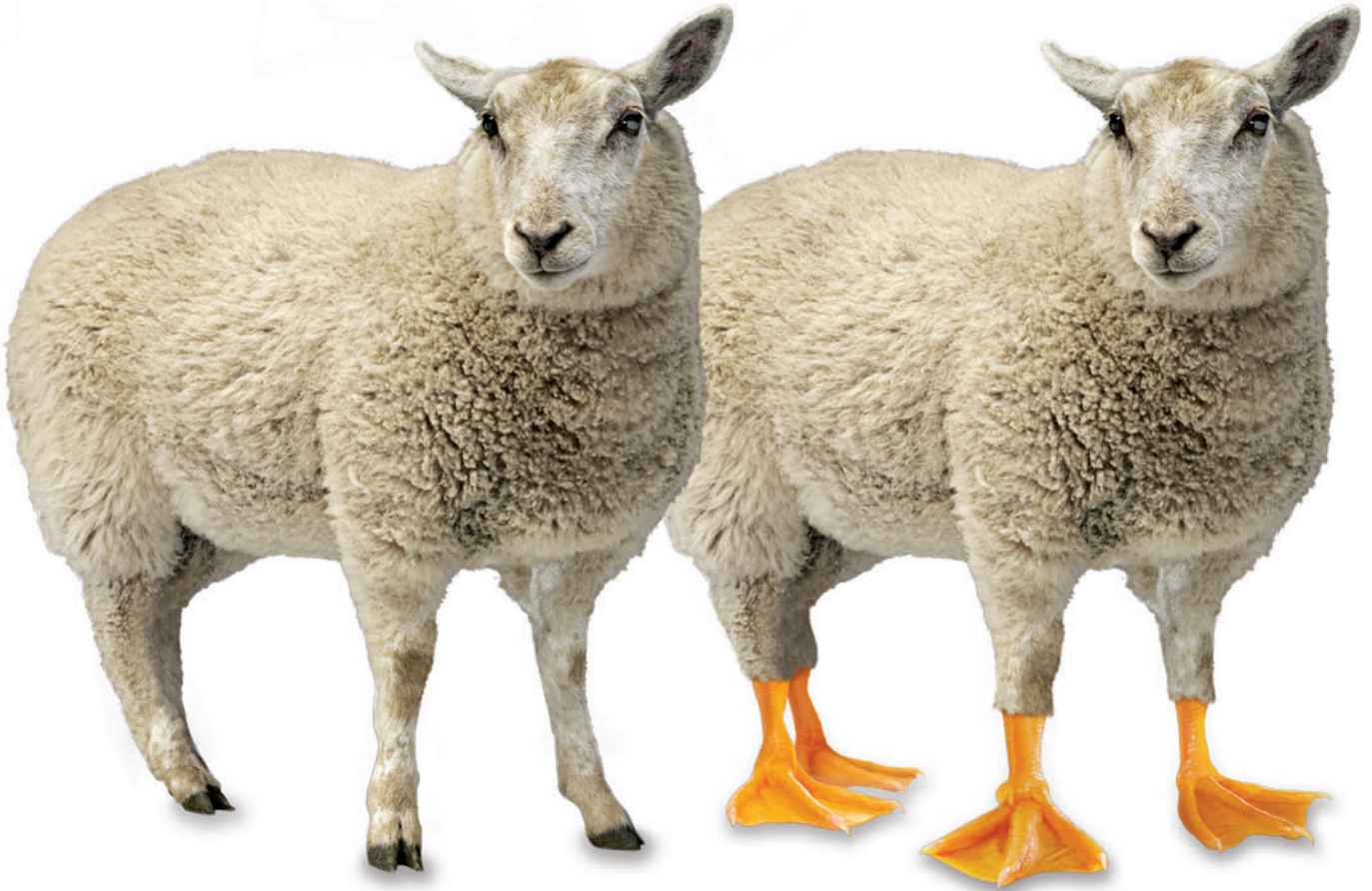
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most authorities agree that R134a is not a good thing for the environment. Quantities of R134a in our atmosphere have grown steadily over the years, and

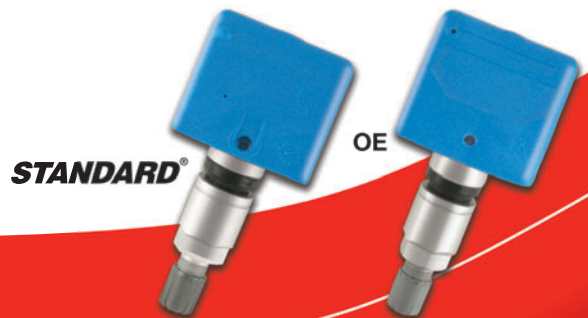
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Pete discusses the EPA's proposal to end use of R134a in new cars  
[MotorAge.com/R134aNews](http://MotorAge.com/R134aNews)

it (along with other hydro-fluorocarbons, or HFCs) acts as an insulating blanket surrounding our planet. Its lifespan is estimated at more than 13 years, so the impact is multiplied over time.

How it all got there is a matter of debate, but let's just say that is one reason why organizations like the Mobile Air Conditioning Society (MACS) and noted members of the Society of Automotive Engineers (SAE) Interior Climate Control committee have been advocating the ban of small DIY cans of refrigerant like those you can find in every Walmart in the country.

The European Commission was the first to act on HFCs, or "F" gases. In 2006 or so (EU Directive 2006/40/EC), it officially banned the use of R134a in new model platforms for sale in the European Union beginning Jan. 1, 2011, and gradually phasing out use in new vehicles for sale altogether Jan. 1, 2017.

What model year are we in? Keep that in mind.

Specifically, the EU MACS Directive requires the use of a substitute refrigerant that has a Global Warming Potential (GWP) under 150. GWP is a comparative measurement of how greenhouse gases trap in the atmo-

sphere, with carbon dioxide as the baseline (CO2 has a GWP of 1). R134a has a GWP of 1,300, meaning 1 gram of R134a is 1,300 times more harmful than 1 gram of CO2. While it will not meet the requirements in the EU for use in new cars, it is important to note that this directive is not a phaseout,

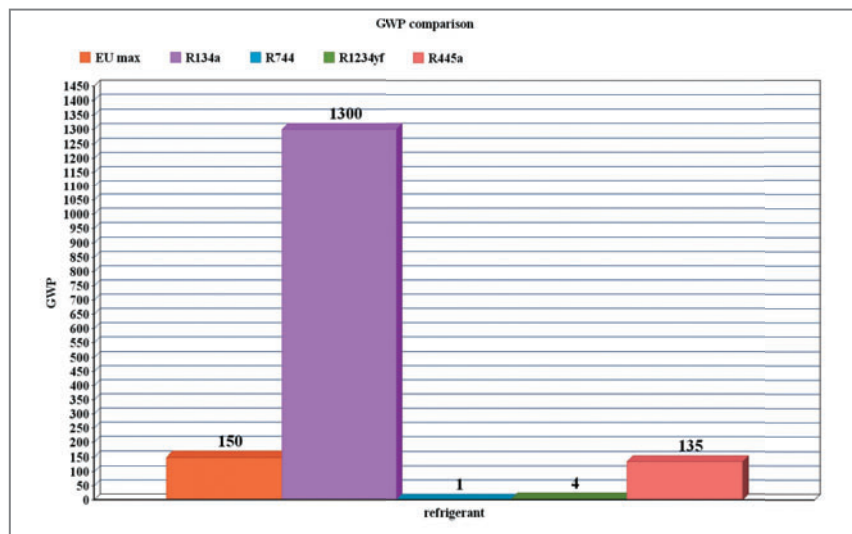
but a phasedown. That means vehicles on the road already can continue to use R134a until they naturally pass out of the fleet.

The EPA's proposed rule means the same thing here in the United States. They are not banning the use of R134a EXCEPT for use on new vehicles. So the answer to one of the questions on everyone's mind is that there are currently no plans to retrofit any existing R134a system to a different gas. Thank goodness, you'll be saying, as we continue this discussion.

So, with what are we going to replace R134a? You might think you know the answer.

**The contenders**

The search for a replacement for R134a featured several possibilities. Nearly any gas can be used as a refrigerant. It all depends on the pressure/temperature relationship of a gas on just how



GWP is a comparative number, with CO2 as the baseline. Here is a comparison of the different refrigerants and the EU requirement.

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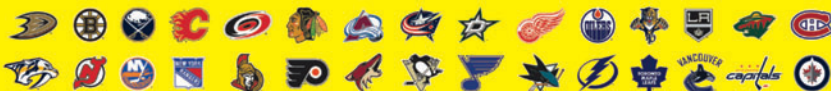
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effective it may be. With that in mind, let's take a look at some of the early contenders.

One of the first to be considered was R744, or carbon dioxide. Kind of hard to beat the gas used as a baseline, isn't it? But the use of R744 (every refrigerant receives a nomenclature beginning with the letter R) posed some problems. The system itself requires high operating pressures, in excess of 2,000

psi, and some automakers thought that was not a good thing to have in the passenger cabin.

One solution to this potential safety hazard was the use of a "secondary loop" design. In this design, a coolant fluid (antifreeze) was cooled by the refrigerant circuit and then passed into the cabin, where the coolant was used for the transfer of heat. It prevents the exposure of high pressure in the cabin

by keeping all the refrigerant components under the hood, but increases cost and complexity.

R744 is not as efficient as R134a, according to some sources, and cars equipped with this refrigerant in the U.S. might do a dandy job when the car is in Fond du Lac, Wis., but fall short when faced with the demands a city like Phoenix would place on it. In addition, the impact of greenhouse gases not only is measured as a result of the gas itself, but the energy consumed by the vehicle to operate the air conditioning system. Some claim that R744, overall, actually pollutes more when considering this additional factor.

Another potential candidate was R152a, a refrigerant commonly found in those little canned air products you use to blow the dust out of your computer's keyboard. Its properties were similar to R134a, making system design changes relatively simple to accomplish. Unfortunately, R152a is classified as a flammable material. Considering all the stuff that can catch fire under the hood of any car, this factor could be mitigated with the addition of safety features but that represents extra cost in production.



Photo: MACS

Get used to seeing this label and notice both the flammability warning and the qualified technician only symbol.



Photo: DuPont

Sold in 10-pound containers, expect R1234yf to cost about 10x more than 134a.

**Though behind schedule and past the deadline required by the MAC Directive, the first cars equipped with R1234yf were sold in Europe in March 2012.**

Both alternatives also faced serviceability concerns, and raised questions on whether additional certifications should be required before allowing technicians to work on them. But let's be real. Joe Bob doesn't have any certifications now and is trying to fix R134a systems in his driveway based solely on how his dad used to do it back in the R12 days. Any shop that has seen a car come in with an overcharged system, or one filled with something other than the correct refrigerant, knows that

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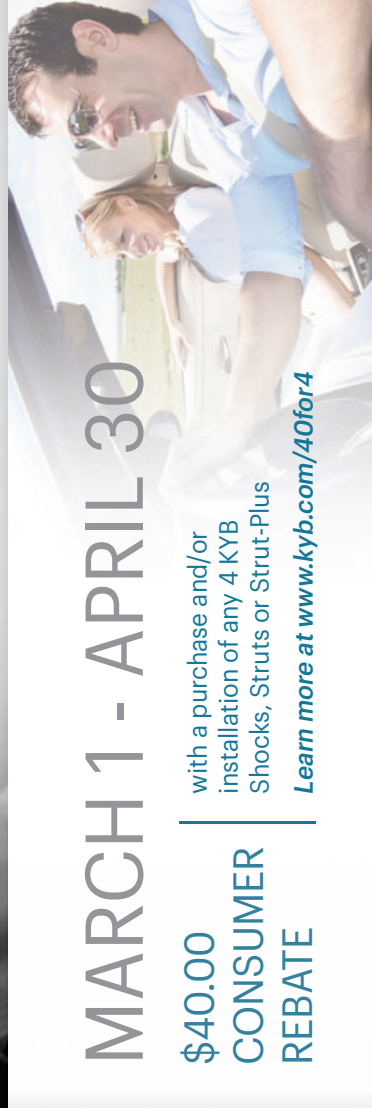
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requiring certification and enforcing it are two very different things.

A third gas presented as an alternative is the one that eventually won out: R1234yf, also known as HFO1234yf. With a GWP of <1 (according to the United Nation's Intergovernmental Panel on Climate Change), it certainly meets the requirements of the European Union directive. Its pressure/temperature characteristics also are close to that of R134a, making it almost a "drop-in" replacement.

Naysayers at first pointed out that R1234yf is also flammable — albeit "mildly flammable" — but numerous

tests performed by automakers and SAE Cooperative Research Projects have proven time after time that the refrigerant is safe for use in automotive A/C systems. Though behind schedule and past the deadline required by the MAC Directive, the first cars equipped with R1234yf were sold in Europe in March 2012 (as reported in the European Fluorocarbons Technical Committee newsletter).

### Problem solved?

Remember, the EU MACS Directive only applied to vehicles built for sale in the European Union countries. No



Each refrigerant requires its own dedicated RRR machine. What happens when R1234yf is fitted to hybrids? Another machine?

Photo: Robinair



Photo: Pete Meier

**Always good practice: Checking the quality of the refrigerant in the car before recovery will be mandatory on R1234yf systems. It's incorporated into the RRR equipment.**

other country in the world, including the U.S., had made any indication that it would follow suit. There was and is, however, a huge incentive for domestic manufacturers to make the switch. It's called CAFE, or Corporate Average Fuel Economy, and it is the fleet fuel efficiency mandates issued by the Federal government.

Currently, CAFE standards require that the average fleet fuel economy for cars and light trucks meet or exceed 54.5 mpg by the 2025 MY. That explains the growth of hybrid and diesel offerings, and the renewed interest in hydrogen fuel cells. But even that may not be enough for some manufacturers, who need to earn or buy "credits" they can use to offset the mandate. Some companies, like Tesla, have an abundance of credits and sell them to other manufacturers like product. Alternatively, credits can be earned by using green systems, and HFO1234yf air conditioning systems qualify.

GM was the first American company to add R1234yf systems to its product lines, specifically the Cadillac XTS, and has plans to expand the use over time to all its models. Chrysler has since announced that it, too, will be mak-

ing the move (not all at once, but over time) on its lineup. Asian manufacturers have already added some models to their North American market offerings utilizing the new gas.

But one of the very first carmakers to produce an HFO1234yf-equipped car for sale in the U.S. was Mercedes-Benz (Daimler). Certain 2013 SL-class models arrived equipped with 1234yf systems (made in late 2011/early 2012). That was, however, going to lead to a firestorm in the industry later that same year.

### Daimler pulls out

Not long after these models made their way on shore, Daimler issued a press release that stated, in part, that its own testing revealed what it considered to be serious safety issues related to the use of R1234yf. Daimler also announced a recall of the models it already had produced using the new gas, and its plans to refit them with R134a.

On top of that, Daimler stated (for the record) that it would not abide by the EU directive and would continue to use R134a in its product lines for sale across the globe until a suitable replacement (in their opinion) could

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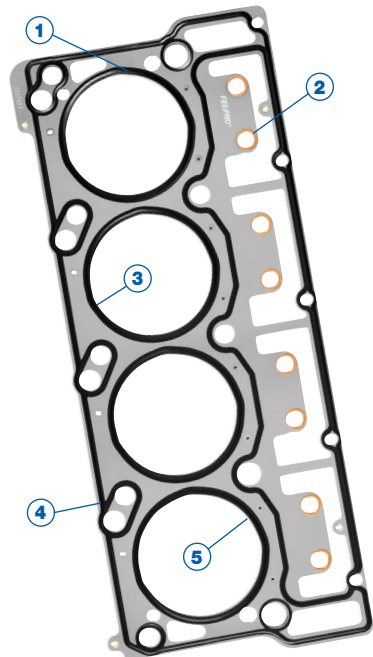
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be found. To date, no other OEM has backed Daimler's claim — although some German automakers have stated that CO2 is their preferred choice. This wasn't all that surprising to some, because the German automakers had been relatively steadfast in their desire to use R744, and in their resistance to 1234yf, from the beginning.

This led to more soap opera developments than an episode of "All My Children." Many criticized the methodology of Daimler's findings and remarked that they, along with their German counterparts, had all been part of the original testing of the now-questioned refrigerant. Member nations of the EU were openly critical of the automakers' refusal to meet the Directive's requirements — and of the German government for enabling them to do so. In fact, formal infringement proceedings against Germany were initiated on Jan. 23, 2014.

Is it really a matter of safety? This is my personal opinion, but consider the facts: The German automakers were bent on using CO2. Other automakers were not so keen on the idea, though, for reasons we've already discussed. Daimler and the others were directly involved with the selection process, and even the German automotive trade association (VDA) called for a global consensus on what single refrigerant would be used, and for obvious reasons. After extensive testing involving more than a dozen vehicle manufacturers and even more suppliers, it was agreed that HFO1234yf would be the best choice.

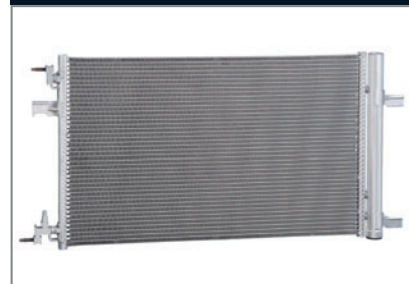
Yet here we are. As one editorial review put it, it's akin to the age of VHS versus Beta. Sony was convinced, until the end, that Beta was the better of the two. In my humble opinion, we are seeing a similar situation here. Only it's not going to cost the manufacturers, it's going to cost us.

### Now what?

First, don't throw out your R134a equipment just yet. Even though it is highly likely the EPA will use its authority under the Clean Air Act to mandate the phasedown of R134a, it will be just that — a phasedown as opposed to a phase-out. That means that all the vehicles currently out there using R134a will continue to do so until they fade from



Considering a new leak detector? Make sure it works on HFC and HFO gases.



Replacing the desiccant anytime you service an A/C system is always good practice and typically easy enough. But at least one make (Chrysler) is making this an unserviceable part on its 1234yf systems, requiring condenser replacement instead.

the landscape. No retrofits, and that's a good thing, considering the high cost of HFO1234yf (Chrysler MSRP at your local dealer is \$1,236.80 for a 10-pound container).

Second, consider HFO1234yf a refrigerant that is here to stay. Fortunately, the learning curve for servicing and repairing these systems is not too steep. Basic operation and troubleshooting will be the same as we're used to on R134a systems.

You will, however, need dedicated service equipment to work on these vehicles. RRR machines will be equipped, and require, some form of refrigerant identification before they will allow you to recover what's in a car, and the mildly flammable classification will necessitate different storage and handling techniques. Additionally, evaporators used in cars

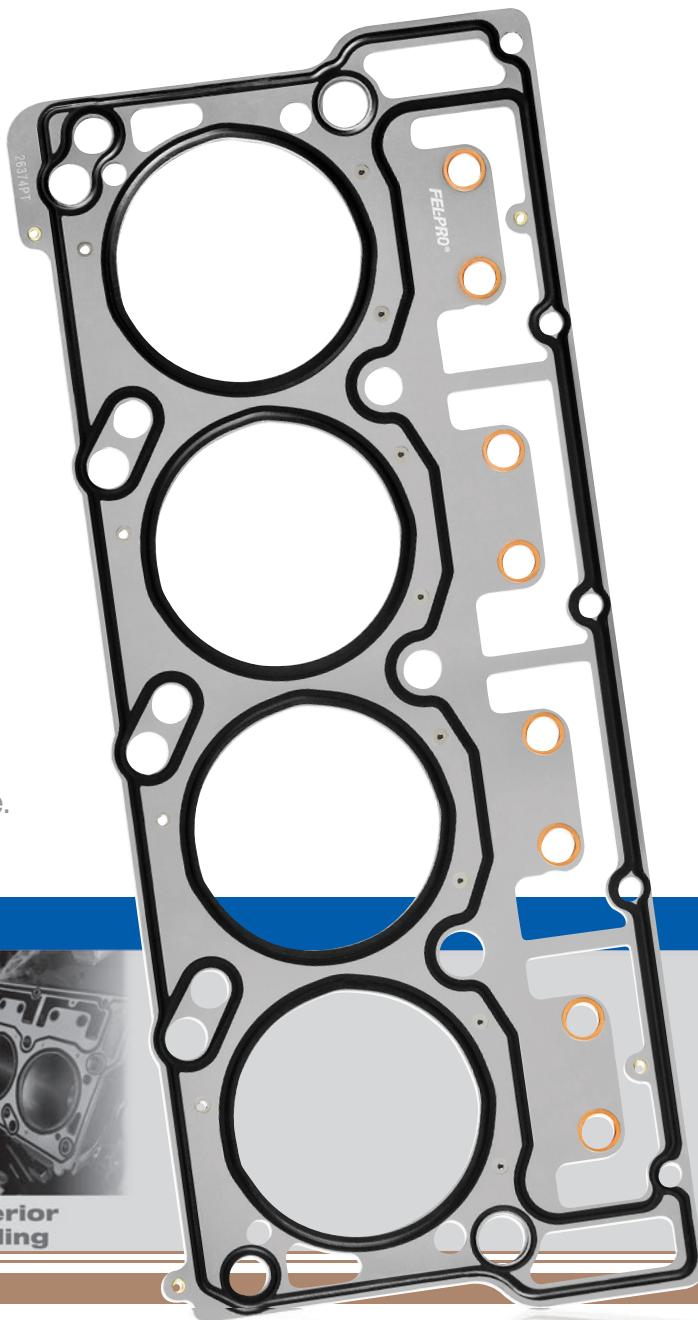
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equipped with the new gas are more robust to prevent potential leaks in the cabin and must be replaced with a new, certified unit — no soldering and no junkyard swaps.

From a purely business standpoint, you might ask yourself whether it's time to enter the HFO1234yf service market. These cars will be under factory warranty for some time, so unless you're a collision shop that needs to recover or recharge systems after repair, or your shop is in a market not easily serviced by a dealer, you might want to hold off awhile to see that develops in the A/C landscape.

And that leads us to Point No. 3: What other refrigerants might we see in the future? Peering into the crystal ball I used 5 years ago, I see R744 appearing in the European models. That means another dedicated piece of equipment — and, at the least, formal training for dealing with such a high-pressure system. I don't foresee the average shop servicing these cars any more than shops today service Euro drivability issues, but some of our read-

ers who specialize in European service might keep a watchful eye on the horizon, as the drama in the European Union continues to unfold.

Under the radar is a potential challenger to HFO1234yf: R445a. Produced by Mexichem and also referred to as AC6, it's a blend of 85 percent 1234ze(E), 9 percent 134a and 6 percent 744. Said to be significantly cheaper than HFO1234yf, it is also a low GWP refrigerant that is at press time awaiting addition to the EPA Significant New Alternatives Policy (SNAP) list of approved gases; SAE is already working on standards. If picked up by manufacturers concerned over cost, that would mean yet another dedicated machine and equipment a shop would have to invest in to service these systems.

Potentially, shop owners and technicians could be looking at dealing with four different refrigerants instead of the one (OK, maybe two if you count the few R12 cars still out there) in the foreseeable future. How soon? HFO1234yf is here today, and I'm betting R744 will

be on the scene within the next few years. Although these new systems will be under factory warranty, collision shops and independents in remote areas may have to deal with them well before that warranty expires.

Will it be worth staying in the A/C business? Will we be seeing mobile A/C specialists like we see mobile diagnostic guys today? It's going to be a challenge, for sure. But we, as an industry, have risen to the challenges of the past. I suspect we'll rise to this one, too. *MM*



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

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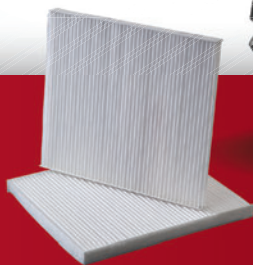


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# WHAT IS FUEL CONTROL?

IT'S THE RIGHT AMOUNT OF FUEL DELIVERED AT JUST THE RIGHT TIME.  
IT'S ALSO BOTH AN ART AND A SCIENCE.

BY JERRY "G" TRUGLIA |  
CONTRIBUTING EDITOR

**F**uel control plays an important part in the engine management system's ability to deliver, control and keep emission levels at specification. Fuel control is the correct amount of fuel mixture, delivered at the right time and that the Engine Control Module (ECM) constantly monitors and adjusts.

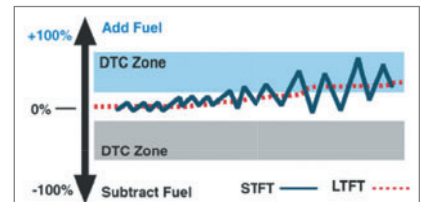
When most technicians think about fuel control, they probably reflect on the days when GM vehicles had carburetors. The objective behind fuel control is to keep the air/fuel mixture at a stoichiometric level (that is, 14.7 pounds of air to every pound of fuel). If you take a trip back to the GM system, you might even remember using the "Integrator" and "Block Learn" scan tool Parameter Identifiers (PIDs) to see what the command was from the ECM. If you were a technician that worked on just European or Asian vehicles, you might not have heard about Integrator and Block Learn, but don't worry. The modern name for Integrator is Short Term Fuel Trim (STFT) and for Block Learn it's Long Term Fuel Trim (LTFT). The numbers for Integrator and Block Learn are different than those used for STFT and LTFT. The number used for a perfect mixture adjustment is zero for both STFT and LTFT rather than 128 for Integrator and Block Learn. With the history out of the way, let's move on to using STFT and LTFT in the real world.

You cannot diagnose vehicles today without using the Generic/Global

OBDII PIDs for fuel trim. In the technician ranks today, there still are many who do not understand what fuel trim/control is all about. This lack of understanding of what is a most fundamental task for the ECM leads to improper repairs and wasted time. In addition, fuel trim data can be used to successfully diagnose a variety of drivability issues, but only if the tech assigned the problem understands how other faults (like misfires and restricted exhausts) will have an impact on the numbers.

On OBDII vehicles, fuel trim is how much fuel the ECM commands the injectors to feed the cylinders. It does so by controlling the time the injectors remain open. Because fuel pressure is a given, the ECM can calculate how long to hold the injector open in order to deliver a specific amount of fuel. But that's in a perfect world. The upstream oxygen sensors provide feedback to the ECM on how well it's doing its job. The ECM uses this feedback to alter the injector's on time. If the oxygen sensors report a LEAN condition, the ECM increases the length of time the injector is open. To the contrary, if the oxygen sensors report a RICH condition, the ECM decreases the amount of time the injector remains open.

This is the constant switching from negative to positive STFT numbers you see on your scan tool, and is necessary in order to get conventional oxygen sensors to switch voltage. Oxygen sensors, contrary to their name, do not actually measure the amount of oxygen in the



If a problem develops, STFT will try to compensate for the fault immediately. LTFT learns the correction over time. If a correction can't be made, a DTC will set.

exhaust stream, but instead they react to changes in oxygen content. But that's a whole other topic for another time.

The numbers themselves — STFT and LTFT — are percentage adjustments to the "perfect" amount of fuel as determined by the ECM. Zero is perfect, or stoichiometric, fuel trim.

Fuel trim numbers that are positive means that the ECM is adding more fuel than it originally calculated the cylinders needed and fuel trim that is negative means that the ECM is adding less than it originally calculated.

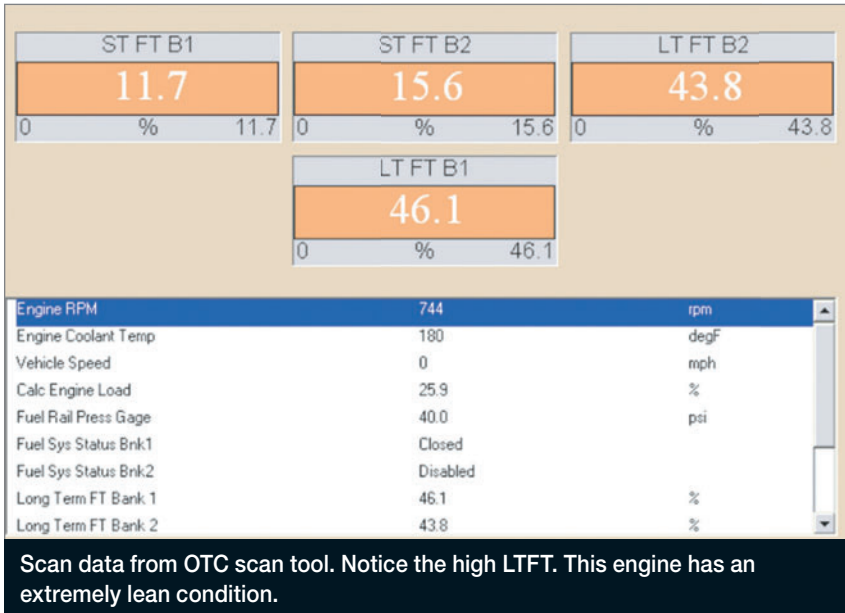
Fuel trim numbers (STFT and/or LTFT) that is more/less than +10/-10 (I use +6/-6 when I diagnosis a

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This failed PCV elbow is all it takes to cause a lean idle condition. Smoke from your EVAP tester, though, makes them easy to find.

**Causes For a Lean Fuel System:** vacuum leaks, clogged fuel filter, worn fuel pump, clogged fuel injectors, HO2S problem, wrong PCM command and mechanical problems.

**Causes For a Rich Fuel System:** high fuel pressure, leaking injectors, EVAP problem, HO2S problem, MAF problem, wrong PCM command and mechanical problems.

Faulty PCV valves can cause vacuum leaks that can force the system to be commanded rich. Some manufacturers keep moisture down and prevent the valve from freezing by heating the PCV valve. Some PCV systems may use engine coolant to heat themselves. Remember if the PCV system is not functioning properly the fuel trim can be affected.

Common DTCs that are associated with fuel control problems are; P0171 (Lean - Bank 1), P0172 (Rich - Bank 1), P0174 (Lean - Bank 2) and P0175 (Rich - Bank 2) along with any O2 Heater, O2 Voltage, or Air Fuel Ratio problems. Always make sure to perform a complete diagnosis of the system to make sure that there is proper input and adjustments from the ECM.

problem vehicle) indicates there is a problem somewhere. Excessively high variances either way (these limits vary by manufacturer) will set a System Lean (ECM is adding more fuel – positive trims) or System Rich (ECM is adding less fuel – negative trims) code.

## Both STFT and LTFT can compensate for a rich or lean condition, but only so far.

### STFT vs. LTFT

STFT is fuel trim in the short term. The ECM constantly moves it up and down, trying to make it as close to zero as possible, equaling the optimal air/fuel mixture. Every time you restart the vehicle, you restart the STFT reading.

LTFT is the average of STFT in the long term. So, if you have STFTs that tend to range between +5 to +15, expect your LTFT to be about +10. While STFT changes rapidly, it takes time for LTFT to move up or down, because it takes a lot of STFT readings to alter the cumulative fuel trim average that is LTFT.

STFT makes constant adjustments in closed loop to keep the air/fuel ratio as close to stoichiometric as possible. Decreasing oxygen sensor

voltage causes an increase in STFT. While increasing oxygen sensor voltage causes a decrease in STFT.

But let's say that the engine starts running lean due to a weak fuel pump. The condition worsens as the fuel pump delivers less and less fuel. To compensate, STFT adds more and more fuel by holding the injectors open longer and longer. As the included chart shows, the trend steadily worsens and the LTFT increases.

Both STFT and LTFT can compensate for a rich or lean condition, but only so far. When they have gone as far as they can, they run out of steam at a point called their Adaptive Limit. When the PCM determines that both are pegged out at their limits, and a severe air/fuel imbalance still exists, it will store a Diagnostic Trouble Code (DTC).

### Fuel trim tips and tricks

**Reset Adaptive Fuel:** Do not forget to reset fuel trim / adaptive fuel or fuel trim before sending the vehicle out the door after performing a fuel trim related repair, such as a clogged fuel filter or defective fuel pump. If not, the vehicle may not idle correctly or suffer new drivability issues until it can correct itself. Clearing the codes is not enough to reset the adaptations. Check your service information on the proper procedure for clearing these learned parameters.



**G. JERRY TRUGLIA**  
CONTRIBUTING  
EDITOR

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

Email G. at [gtruglia@tstseminars.org](mailto:gtruglia@tstseminars.org)

# A DIAGNOSTIC 'CHOOSE YOUR OWN ADVENTURE'

A RECENTLY PURCHASED VW GIVES THE NEW OWNER A WILD SURGE WHILE USING CRUISE CONTROL

BY **SHAUN O'NEILL** | CONTRIBUTING EDITOR

As a child, I used to love to read the “Choose Your Own Adventure” books. For those unfamiliar with them, they consist of one story — typically of the sci-fi or fantasy genre — that offers multiple endings. As you read the story, it gives you the option to “...go to page 8 to stay on the path to the right.” Or “...to fire the rockets, go to page 14.” If you ended up at a bad end of the story, you could start over, or just go back to the last bad decision and try another option.

Diagnosing certain code or no code complaints doesn't seem much different on modern cars. Whether you are a follower of flow charts or come up

with your own plan of attack based on certain symptoms or data, we all are led down a path that may or may not yield the fix for a given complaint. Though we can take many paths to get to the end, in automotive repair there can only be one true ending, and that is getting the car fixed right to get it back to the customer.

Recently I had a chance at my own choose-your-own diagnostic adventure. Just like a well-read book has earmarks and signs of wear and tear, this car wore its history — with its wiring pulled out of wire looms and mismatched splice and dice wiring connectors, not to mention the list of used parts already swapped.

the used car lot he bought it from already has spent a lot of time on it, up to and including installing a used transmission. Unfortunately, the current used transmission is one with even higher mileage than the car (this is a point of contention as well with the used lot, but that is another story).

The car, however, is still doing the same thing that he originally brought it back for, still only after being driven for the 15 to 20 minutes and while in cruise control. The initial code scan showed no Diagnostic Trouble Codes (DTCs) in either the Engine Control Module (ECM) or Transmission Control Module (TCM).

## SURGE SURFER

### 2003 VW GOLF

Vehicle Year/Make/Model

### 2.0L (AVH)

Engine

### 01M (4 SPEED AUTOMATIC)

Transmission

### 97,000

Mileage

### COMPLAINT

Won't go into fourth gear and has a lack of power at highway speeds when in cruise control after driving for 15 to 20 minutes. The speedometer seems funny at times, too.

### A Golf apart

The vehicle in question is a 2003 VW Golf with only 97,000 miles on the odometer. The complaint is a big lack of power and unable to get fourth gear when hot. “Hot” in this case is after a 15- to 20-minute drive. The customer had just purchased this vehicle, and

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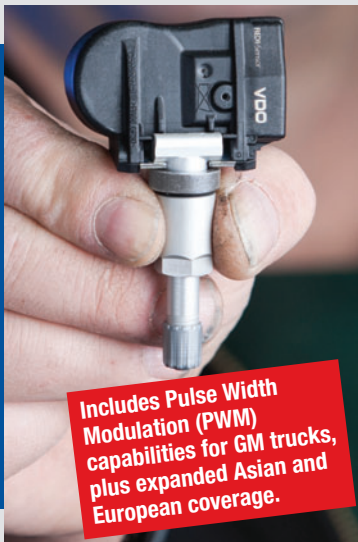


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After a first glance at the complaints, my mind was aflutter with “what could cause that?” type of questions. The first path I usually go down in a situation like this is probably the same one we all go down — or should — and that is the path of confirming the customer complaint.

The end of that trail yielded some interesting results. First, it changed my mind of the description of the complaint.

The customer was right about a couple of things. You could set a stopwatch to the 20-minute mark and this thing would act up. The symptom, however, would be best described

as a severe surge at cruising speed, though, and not a lack of power. The transmission would shift from 4-3-4 repetitively, with huge surges in engine power as well. This happened only while in cruise control, interestingly enough. The symptoms took me by such surprise that it wasn't until I canceled the cruise control that I noticed the erratic speedometer.

The speedometer continued to bounce, and varied anywhere from 5 to 15 mph at times. It was worse at highway speeds going from 70 to 60 mph, and at slower speeds like 45 mph would move only 3 to 5 mph. If you drove slower, the bounce in the speed

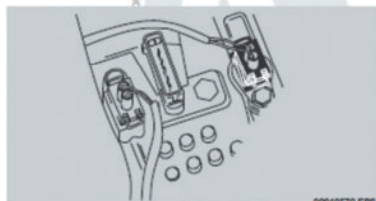


The used VW that was just bought and had a surge during cruise control.

**Sensors**

**Vehicle Speed Sensor (VSS) G68**

This inductive sensor is mounted in the transmission case. It calculates the output speed of the planetary gearset by measuring the speed of a pulse rotor mounted on the input gear to the final drive.



The connector is black.

**Use of Signal**

Information regarding vehicle speed is required for:

- The decision as to which gear should be engaged
- Cruise control system
- Torque converter slip control
- Shift quality

**Effects of Signal Failure**

- The control module uses the engine speed as a substitute signal
- The TCC is no longer closed
- Shift quality is no longer measured

This is a screen capture of a VW SSP mentioning G68 as being used for speedometer and cruise control function. This turned out to not be the case on this vehicle.



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was less noticeable, and if you engaged cruise control, the surge was also less.

Based on these facts, it was time to come up with a plan, or at least a path to go down. The scan tool confirmed the erratic vehicle speed readings, so I was thinking of heading to the transmission side of things next.



### A winding road (or two)

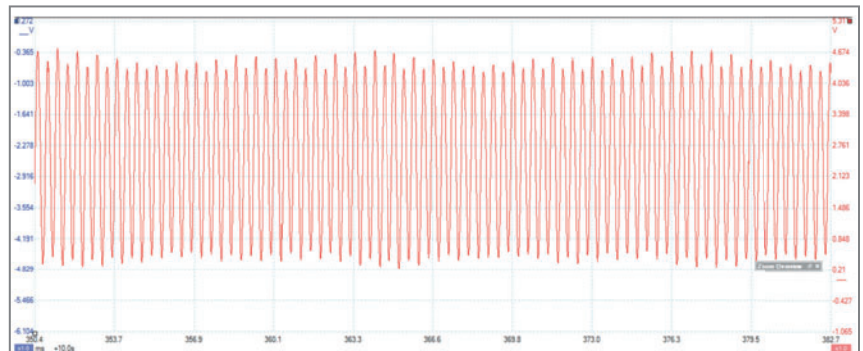
This 4-speed transmission known as the 01M has been around for a while. It has three speed sensors on it, and the terminology of them can be a bit confusing. The first in VW-speak is called G38, and in English called "Transmission Speed Sensor." It also can go by a more job-appropriate description of Input Speed Sensor. I ruled out this as a possibility, because it does not have

an impact on the vehicle speed reading.

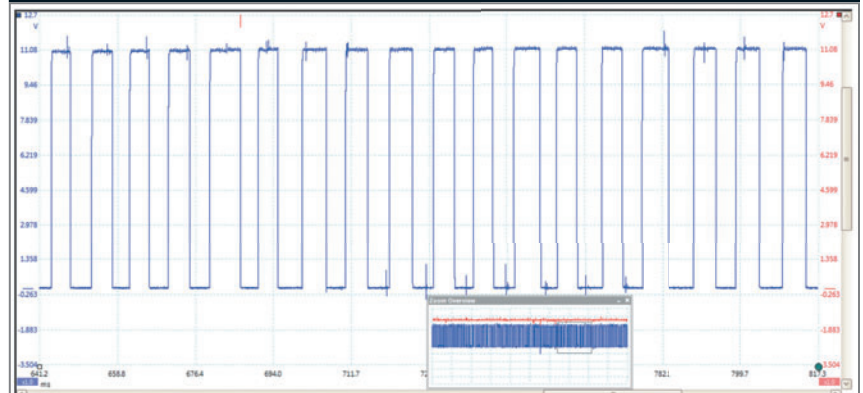
The next sensor in line is G68, or the transmission vehicle speed sensor, more appropriately named the Output Speed Sensor. This is where the plot thickens — and I veer down a path that, not to spoil the story, went nowhere.

VW service information mentions G68 as a main input for vehicle speed signal and cruise control operation. There were signs that someone else went down this road, as the wiring harness connector was spliced in with one from a different car, judging by the wire color changes that took place at the splice area.

At the time, this felt like the right path to go down. But while scoping the signal and driving the car and 20 minutes later exactly, it started to



This screen shot is of scoping G68 while under a steady cruise at 70 mph. The speedometer was bouncing, but this signal was very even and consistent — not the source of our surge, it appears.



This is the scope capture of G22 while driving at a steady 70 mph. Note the not-very-even switching of the signals. Some are wider or shorter than the very next pulse next to it.



Here is the G68's new harness connector that someone already tried. Note the wire color change.

surge and act up again. The signal on G68 however was steady as could be — at least, steady enough that it couldn't be the source of the speedometer fluctuations and hence the surge under cruise.

I was starting to doubt this path by now. Most G68 problems I've seen in the past throw DTCs pretty easily when there are electrical issues, and performance problems usually result in gear ratio codes. This hindsight and the current data caused me to backtrack.

There is another speed sensor on the transmission called G22. This one, it turns out, is labeled the speedometer vehicle speed sensor. It still is called a Vehicle Speed Sensor (VSS) in the wiring diagrams just like G68, but G22 was not listed on the transmission wiring diagrams. G22 was found only in the instrument cluster wiring diagrams on ALLDATA.

Upon closer examination, there was evidence yet again that someone had been down this road. G22 had some wires pulled out of its wire loom as if someone did some testing in this area



Borescope of G22 reveals the split drive gear ring of the speed sensor.

already. Testing at G22 started to feel like the right path after the next test drive. The time it took to get the complaint to act up was less now, but that most likely was due to the fact the car never cooled down completely during the rearrangement of the scope leads.

But during the test drive at the time of the surge in cruise — or out of cruise, for that matter — the signal on G22 was showing some erratic signals. I had expected a steady frequency while maintaining a steady speed, but was getting anything but that. At this point, since the transmission already was replaced, I was thinking that maybe some of the sensors were swapped from the original transmission and reused on this one. Fortunately, we had a good used G22 from various cores lying around the shop. But alas, the same problem persisted.



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## Closing in

By now it felt like the whole mystery had been read cover to cover, just like it was before by someone else. The only other thing that could cause an erratic switching of the Hall Effect speed sensor G22 other than a sensor issue itself would be an issue with the drive gears of the sensor. A borescope was sent down the G22 hole into the differential section to check out the drive gear. As

the tires were rotated, a big split in the G22 drive gear was discovered.

When the customer was informed that his transmission would either have to be removed to put a new drive gear on the differential or be replaced yet again, he was a bit surprised. The car lot was a bit disbelieving, too, unfortunately, which makes me wonder how they decided to swap the transmission in the first place.

In the end, the car lot wouldn't or couldn't help its customer out further, and the customer opted for yet another used transmission. This one had lower mileage, at least. Fortunately, he still had his original transmission that started this whole ordeal and was kind enough to drop it off so we could take the differential cover off of that one, as well as his used one that currently was in the car when it was removed for the "here-we-go-again" swap.

The results weren't surprising; they both had split speedometer drive gears on the differential that would even spin when putting a bit of pressure on them by hand. When the "new used" transmission showed up, the cover was pulled off that to inspect and make sure a three-peat of the story didn't happen — and that was revealed was a nice tight, split-free drive gear.

Once the next transmission was installed, the problem was gone. The speedometer was nice and steady at all speeds, and cruise control worked flawlessly as well, because the PCM no longer was chasing an erratic speed reading. In the end, the car was fixed and a satisfactory conclusion to this story was reached.

Of course, with hindsight being 20/20, it was obvious what *could* have been done to reach the same results sooner, but when faced with certain paths in the heat of the moment, sometimes we head down the wrong path(s). Sometimes when there is evidence someone else has walked the same trail, it's easy to convince ourselves to do the same thing as well.

In the end, though, if the answer or the path you're on isn't right, go back and start again on a new path until the right answer is found. And even if the path you're on was well traveled, you still just might reach a different conclusion than others who went the same way. *TLZ*



These images are of the transmission after it was removed. The differential side cover was removed for reference of the speed sensor to drive gear relationship. Also, the crack can be seen with the sensor removed.



Shaun O'Neill is a third-generation transmission rebuilder for his family business O'Neill's Transmission Service in Grand Rapids, Mich. He is a CMAT with L1 and L2 and has helped co-write a transmission diagnostic training class for Standard Motors Corp.

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- Chase down short circuits without blowing fuses
- 5-30 amp breaker handles



**DISC BRAKE SYSTEM ANALYZER #7884**

- The only tool to identify imploded brake hose
- Accurately detect the problem without breaking a line



**90° MULTI-PORT AIR GUN**

**AIR COMB® #8050-8053**

- Thoroughly cleans air filters, condensers and radiators from the inside out
- Focused high pressure output
- Available in four sizes: 12", 24", 26" and 36"

**5X**  
the air volume



**FUEL FILTRATION AND TRANSFER**

**FLEET TANK SWEEPER #9049M**

- Lightweight and portable
- For tank applications including trucks, tractors & 55 gallon drums



BEFORE

AFTER



CONTINUED FROM PAGE 25

“The visual projection of your internal thoughts and feelings being demonstrated through your behavior.”

### Competent staff

The independent sector of the automotive aftermarket industry is truly in the knowledge business today. Competency is critical in a successful shop. Do you evaluate your staff's knowledge inventory on a regular basis? Are all members on your staff properly trained to do what you have asked them to do, or are they “kind of” trained? Skimping on proper training leads to shop failure today.

Training is a measurable investment, not an expense. Training is also a management responsibility — that is, management must search out the right training courses for all staff members to attend, even if it means shutting down the business for a few days. When the right training has been achieved, then all people on the staff, namely, all technicians, service advisors, bookkeepers and management, all are on the same page at the same time.

Does your staff truly understand why they come to work Monday morning? Competent staff understands the culture of the business and how the numbers of the business work in order to produce business net income so all members on staff can enjoy top marketplace wages. Too many shop owners complain they cannot find and retain good staff. Well, there is only one answer to that question, and it is with another question: Why does your shop not attract the best staff in your marketplace?

### Right business measurement

Too many shop owners have not been taught how to measure their business. They just watch their sales and their bank account balance. Just focussing on activity does not produce the right net income. It is a fact that the average shop in the aftermarket is missing out on between \$60,000 and \$90,000 net income per year on the current business coming through the door. This is an incredible amount of money that could change one's life, and shop's future, when discovered where it is — as it would be the same additional

amount of money per year for the balance of your shop career when executed properly.

Why does our sector of our industry not want to learn this? There are a few common reasons tossed about:

- I don't believe it.
- I don't have time (for anything that worthwhile, but lots of time for hunting, fishing and racing).
- It costs too much.
- I know everything I need to know.
- That is why I have an accountant.
- I'm doing OK, for now.
- When I get the best price, I know I'm doing it right.

Did you ever notice something about the independent sector of our industry? The weak players focus on price to save money, while the strong players focus on value to make money. Which one are you? Do you measure your business on cost or on profit?

More than 95 percent of the shops in the aftermarket have an accountant that does not understand the independent sector of the industry, as they produce shop financial statements putting technician's wages in as a cost of labor revenue. This is called cost accounting, and for our sector of the industry, it is the wrong way to measure an independent shop's business. We require a management accounting format, as our firm has taught our clients, “If you can't measure it, you can't manage it.”

### Service level execution, squared

This is the critical portion of the formula for the customer/client to experience. When you examine the real competition, they have concentrated on customer/client retention, facility appearance and the overall customer/client experience when having their vehicle serviced. To execute at a professional service level today, every staff member must be on board and understand the consequences of their actions with the customer/client.

This means the technical and front counter staff must clearly understand their positions within the shop. This is called accountability. When they do not understand, then shop stress moves up, attitudes are negative, comebacks occur too often, staff turnover is common, consumer complaints are too frequent, the facility is not looked after

and everyone, including management, sees everyone as customers and no one as clients. When a shop builds a clientele, then the shop understands its full responsibilities to each and every client.

This is a culture within the shop. In the best shops today, true client service levels are achieved because management took the time, made the investment to learn, then executed the blueprint for shop success. Their service level is second (squared) to none. The shop enjoys a loyal clientele; staff and management are rewarded with way-above-average wages; and the shop enjoys a fabulous net income every year. This is a business process that must be learned by everyone involved within the independent sector of our industry.

As I hope you can appreciate, the formula is detailed, and I have only touched the tip of it in this article. If you think you only need to try to work with one or two items within the formula, you definitely will miss the detail required in business management that makes an independent shop financially successful and prosper today. Consider that it is time for management, and the right hand person within the shop, to make the time, write the check and enroll in the course that prepares and supplies you with the tools to properly manage all facets of your business.

The last thing our industry needs today is another how-to sales or informational seminar. We truly need proper business acumen/education, and when management clearly makes this acknowledgement that this is what is required within our shop, then a giant step forward has been made for everyone working within the walls of the facility. ■■■



**BOB GREENWOOD**  
CONTRIBUTOR

Bob Greenwood, AAM, is president and CEO of Automotive Aftermarket E-Learning Centre Ltd. (AAEC), a company focused on providing business management resources and development for the independent sector of the automotive aftermarket industry utilizing the Internet environment. Bob has more than 36 years of business management experience within the independent aftermarket industry, consulting independent retail shops on all facets of their business operations. Bob is one of 150 worldwide AAM approved instructors.

✉ E-mail Bob at [greenwood@aaec.ca](mailto:greenwood@aaec.ca)

# KEEP YOUR GENERAL MOTORS CUSTOMER COOL – IN THE WORKSHOP WITH ACDELCO

**Pete:** We're going to focus on AC today. Let me introduce Gwen Bowman, ACDelco Product Specialist HVAC Systems, and Jason Sharer, ACDelco Regional Supervisor. Jason has spent most of his career with ACDelco as a trainer. So we have both the tech and the product side of ACDelco here today. Of course, ACDelco is an OEM supplier for GM, as you all know, but they also have products available in the aftermarket. When it comes to AC and AC compressors, you want to make sure you do the job right. You want a product that's going to meet or exceed what the OEM equipped that vehicle with.

**Gwen:** You're absolutely right. ACDelco offers outstanding GM OE form, fit and function. We have first-to-market coverage for all our products. We are a GM-only line. Our parts meet GM OE specification in terms of form, fit and function. We don't offer any universal parts for any repairs. We like to consider ACDelco your one-stop-shopping location for your HVAC maintenance and repair needs. If a customer would like to purchase our parts, they are welcome to check with your local retail outlets, warehouse distributors and, of course, you can go to [ACDelco.com](http://ACDelco.com)

**Pete:** Jason, you're on the technical side of things. What are common mistakes you are seeing when it comes to AC service?

**Jason:** During the diagnosis — for a leak for example — a lot of the guys like to install dye so they can find the leak more effectively. Dye is 90% oil. If you're checking a leak that someone before you has tried to diagnose or find as well, there could be several injections of dye into that system. That causes a capacity problem, where the compressor is going to work at a higher temperature, where the temperature pressure relationships will increase, and it eventually can cause failure of that compressor. Or after the compressor was replaced for catastrophic failure, maybe the system wasn't flushed properly to remove debris. This causes the new compressor then to have a failure.

**Pete:** Recently at the MACS convention, they showed us a report of service needs. Replacing compressors is really starting to fade from the landscape. It seems compressors are living so much longer than they have in the past, so I'm certain there are things we can do to make sure they continue to live a long life. And if they do suffer a catastrophic failure, there's got to be a reason for it. So you need to find out why the compressor failed in the first place, and fix that.

**Jason:** Exactly — the root cause. With the enhanced systems today, with the lower capacities, there's been a lot of change over to variable displacement systems that are computer con-

trolled, and also with more expansion valves vs. maybe the old orifice tube type systems. An expansion valve can very easily cause a compressor failure. So if you just replace the part that failed, and not diagnose the system to find the root cause, then the new compressor's life span is going to be severely shortened as well.

**Pete:** GM is the first domestic manufacturer to include HFO-1234yf as a production system. That's technology that you need to know about and be trained in. You can't treat these systems like you did 10 years ago, 15 years ago. Jason, tell us about the training opportunities that ACDelco offers to help technicians get the job done right the first time.

**Jason:** We have training opportunities in several different media. We have video on demand, available online. ACDelco has a YouTube channel. In our ACDelcoTechConnect website, we have access to parts videos with training about installation and servicing. We also have an ACDelco program for the independent service centers called Professional Service Center. When someone is part of that program, they have all the different types of training that we have available to them: video on demand, TechConnect Training programs that are web-based, and our live training. We have live seminars in a lot of areas around the country. We also have instructor-led training — regular eight-hour, hands-on type training that's available to technicians.

**Pete:** The training opportunities ACDelco offers are not limited to just professional technicians. If you're an educator at a NATEF-certified school, the folks at ACDelco want to make sure you and your students also get the training you need. Tell us a little about that, Jason.

**Jason:** At the training tab at [ACDelcoTechConnect.com](http://ACDelcoTechConnect.com), there is a link for a NATEF educator. There are online courses available to educators and students free of charge if they are a NATEF-certified facility.

**Pete:** Thanks for taking the time to hang out with me today! For full information on ACDelco offerings, visit [www.acdelco.com](http://www.acdelco.com). For training products and offerings, log on to [www.acdelcotechconnect.com](http://www.acdelcotechconnect.com).

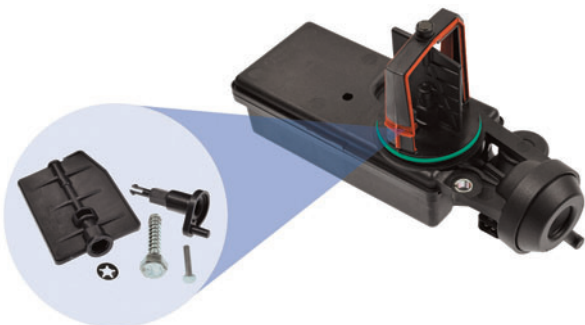


# SMART SOLUTIONS FOR TODAY'S TECHNICIANS IN 2014

**T**echSmart® by SMP® is an exciting new brand of enhanced engine control products developed for the professional service technician. TechSmart® was designed to help the technician with new technology, new categories, and problem-solving improvements to the original with a proven quality they can trust.

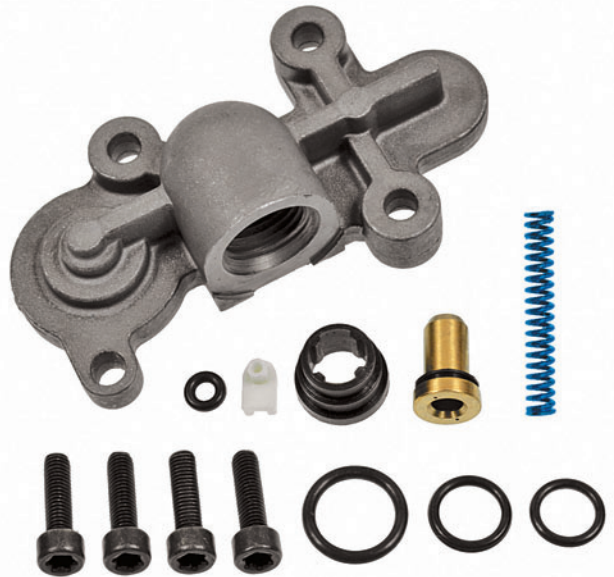
Taking advantage of SMP's rich experience, TechSmart® encompasses SMP® innovation, engineering expertise, superior product quality, meticulous testing, unmatched customer service, competitive pricing and brand integrity. The qualities that have made SMP® the engine management industry leader for more than 90 years are at the heart of every TechSmart® part.

TechSmart® recently introduced part number R81001, a Fuel Pressure Regulator Upgrade Kit also known as the "Blue Spring" Kit for Ford 6.0L diesel trucks. Over time, the spring in the fuel filter housing weakens, causing the fuel injectors to out-flow the stock fuel pump. Symptoms of a weak spring include hard starting, stalling, poor fuel mileage and poor acceleration. The TechSmart® R81001 kit replaces the worn out spring with an upgraded unit and new housing. Most see an increase of 10-15 PSI of fuel pressure. The added fuel pressure will help keep the injectors from out-flowing the stock fuel pump, meaning no air in the injectors and an extended service life.



**The DISA Valve Repair Kit.**

Another new TechSmart® solution for 2012-97 BMW vehicles are the DISA Valve Repair Kits, part numbers F66001, F66002 and F66003. The Differenzierte Sauganlage (DISA) Valve within BMW's variable intake manifold system is used to raise the low and mid-range torque and the top end power output on their most popular engines. The DISA valve opens or closes intake ports depending on throttle input. Over time the valves can stick and the doors can break, causing rough idling and reduced power. TechSmart® has developed an



**The Fuel Pressure Regulator Upgrade Kit.**

affordable repair solution that allows the technician to only repair the part of the assembly that failed. This money-saving kit solution from TechSmart® includes a new flap, a new flap driver, an o-ring, an extractor screw for removing the old door and a new barbed hinge pin for an OE-quality fit and finish.

The TechSmart® line currently includes new (not reman) electronic throttle bodies, HVAC blend door motors and actuators, park assist sensors, keyless entry transmitters, headlight adjustment motors and level sensors, battery current sensors, variable valve timing components, HID xenon headlight ballasts, advanced TPMS service tools, numerous repair kits and more.

TechSmart® products will continue to complement SMP's basic core business. In other words, TechSmart® will continue to be the expert in these categories. That's why every time a professional service technician installs a TechSmart® part... it means "problem solved"!





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AND KEEP YOUR SHOP PROFITABLE

### INTERCOOLER LINE

CSF is proud to introduce the newest addition to its product offering: intercoolers. This brand-new line of OE-style tube-and-fin and heavy-duty plate-and-bar type premium quality intercoolers are now in stock and readily available for order. New models range from the popular Ford and Chevy/GMC trucks, to the Turbo Diesel Volkswagen Passat and popular Turbocharged Chevrolet Sonic, with many more coming soon, the company says.

For more information, visit  
[www.csfradiators.com](http://www.csfradiators.com)  
CSF

### TIRE CHANGER

The new R980ATF is a variable-speed tire changer that performs on a wide variety of wheels, including virtually all ORM and performance tire categories, for wheels up to 25 inches in diameter. It's equipped with a variable-speed motor and gearbox that work systematically at multi-speeds, allowing operators to match turntable rotational speed with varied tire and wheel combinations. Ergonomic controls minimize excessive reaching or bending, resulting in more jobs per day, the company says.

For more information, visit  
[www.rangerproducts.com](http://www.rangerproducts.com)  
BendPak-Ranger



### SWAY BAR END LINKS

MAXXLink Heavy Duty Sway Bar End Links were designed as a durable, cost-efficient and long-lasting solution for the Dodge OEM end links, which are known to have a short service life, the company says. MAXXLinks are also available in extended lengths for vehicles that have leveled or lifted up to 6 inches. The MAXXLink end link system replaces the vulnerable OEM ball-in-socket style link with a simple and robust design. No more changing Dodge's sway bar links every 50,000 miles. Made in the USA from a combination of high grade steel and corrosion-resistant components. Available for 1994 to 2014 Dodge Rams, MAXXLinks can be used as quality replacement parts or as a preventative maintenance measure.

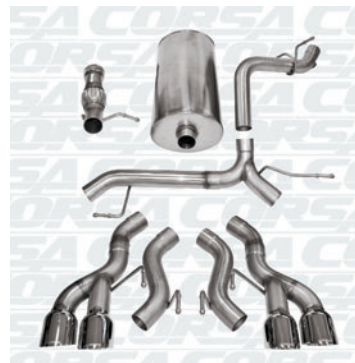
For more information, visit  
[www.suspensionmaxx.com](http://www.suspensionmaxx.com)  
SuspensionMAXX, Inc.



### PERFORMANCE EXHAUSTS

Corsa Performance Exhausts makes available its dual exit, cat-back exhaust system for the 2012-2013 Cadillac Escalade. The sleek, dual, under-the-bumper Series is available for standard Escalades, Escalade EXTs and Escalade ESVs with 6.2L V8 engines. This system is fashioned out of premium 3-inch diameter stainless steel and terminates in a dual rear exit consisting of twin, Pro-Series 4.5-inch tips. For standard Escalades, the Pro-Series tips are available in either a polished (part #14886) or black finish (part #14886BLK). For the Escalade EXT and ESV, the tips also come in either a polished (part #14887) or black finish (part #14887BLK). CORSA exhaust tips are manufactured from high-quality 304L polished stainless steel, feature double-wall construction and are laser etched with the Corsa logo.

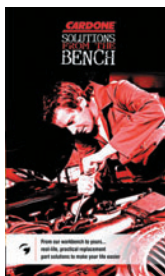
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Corsa Performance



## PARTS GUIDE

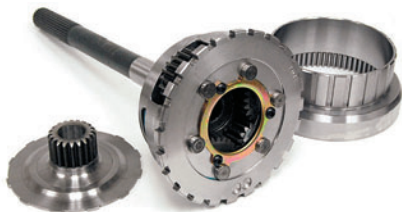
This 16-page guide highlights CARDONE's exclusive new products and hard-to-find parts. Users will also find links to several new short tech tip videos and much more, the company says.

For more information, visit [www.cardone.com](http://www.cardone.com)  
CARDONE Industries



## GEAR SETS

ATI introduces 1.64 and 1.66 ratio, straight-cut, Vasco gear sets for Powerglide Transmissions. These new gear sets accept OEM Powerglide 19-spline input shafts and have an OEM-sized Powerglide output shaft. No case machining needed, accepts up to five OEM-sized reverse clutches, and no other special parts needed for installation. A lightweight billet aluminum carrier is an available option and saves over 2 lbs., the company says. Each gear set comes complete with Flange and Reverse Ring Gear, and are available in both standard 28-inch lengths and as an 18-inch shorty. ATI warranties these gear sets for 2 years against failure.



For more information, visit [www.atiracing.com](http://www.atiracing.com)  
ATI Performance Products

## BRAKE PADS



New Bosch Blue Disc Brake Pads are targeted to general repair shops that service a variety of makes and models. Features include comprehensive coverage of domestic, Asian and European vehicles; advanced platform-specific friction formulas (NAO-Ceramic and Semi-Metallic); OE-style multi-layer shims for enhanced noise-dampening and quiet operation; and rust-prevention coating for improved durability. Their slots and chamfers match the OE design, and its synthetic grease helps reduce resistance on all contact points.

For more information, visit [www.boschautoparts.com](http://www.boschautoparts.com)  
Bosch

## VIDEO SCOPE

The Video Scope with Hyperion Probe is a full-featured Video Scope packaged with ANSED's Hyperion Technology 5.5mm x 1m Probe. Hyperion Technology offers three modes to enhance viewing capability: Light Boost improves image clarity; Mirroring and Image Rotation allows the image to be viewed in proper orientation; and Particle Free and Anti-Reflection reduces image glare and impurities improving image quality. The tool features a 3.5-inch screen, and is shock-resistant for the tough automotive environment. Screen images can be viewed and recorded in Inspection, Snapshot and Video modes. Date and time is displayed and transferred to picture and video recordings. A 3x and 5x digital zoom allow for close-up inspections. Probes are IP67-rated, dust- and fluid-resistant for a wide range of applications, and include a 110-degree screw-on mirror and a 4GB SD Card.



For more information, visit [www.anseddiagnostics.com](http://www.anseddiagnostics.com)  
ANSED Diagnostic Solutions

## SEALANT AND ANTI-VIBRATION COMPOUND

STS/Tectorius debuts VIBRA-STOP thread locker, sealant and anti-vibration compound as an aerosol spray. VIBRA-STOP overcomes traditional roadblocks that prevent thread-lockers from being packaged in spray applicators. The original brush grade and high-temperature version remain available for purchase. VIBRA-STOP product differs from other thread-locking compounds in a variety of ways, the company



says. Coated pieces can be removed and reused multiple times. Installation can occur immediately or indefinitely after application of VIBRA-STOP. The formula is effective on metallic and non-metallic surfaces, and works on both threaded and non-threaded fasteners.

For more information, visit [www.tectorius.com](http://www.tectorius.com)

Tectorius | Solid Technical Solutions | Maelstrom

## GREASE GUN

The new 20V MAX grease gun (DCGG571) delivers 10,000 maximum PSI and a flow rate of up to 5.0 ounces per minute (the maximum initial battery voltage, measured without a workload, is 20 volts; nominal voltage is 18). High pressure is especially helpful for unclogging seized grease fittings and properly tensioning the adjusters on tracked equipment, the company says. The grease gun's fast flow rate allows operators to quickly complete their daily maintenance activities. With the use of a DeWalt XR 4.0 Ah lithium ion battery pack (DCB204), the 20V MAX grease gun can dispense up to 16 14-ounce cartridges on a single charge. The variable-speed trigger allows the user to control the amount of grease that is dispensed, which can speed up application time or conserve grease during applications. The unit's pump filter screen helps to keep dirt from passing through the pump mechanism, and the built-in bleeder valve allows the user to bleed excess air that can often become trapped in pump valves, affecting the pressure and speed of application. The grease hose measures 42 inches long for easy grease applications in hard-to-reach fittings, and the bright LED light helps to illuminate fittings that are difficult to locate.



For more information, visit [www.dewalt.com](http://www.dewalt.com)  
DeWalt Industrial Tool Co.

## THREAD REPAIR

Engineered to repair damaged or stripped threads during auto repair, the new Fix-A-Thred® Kit features inserts, tap, instructions and an exclusive three-way installation tool. This tool rethreads the hole, installs the insert, and breaks the tang. Fix-A-Thred Repair Kits are available in a wide range of sizes for both Unified Inch Coarse (UNC) and Unified Inch Fine (UNF). Kits are available in 33 of the most popular sizes, from #8 through 1 1/2-inch UNF. Metric repair kits are available for coarse and fine threads from M.3-.5 to M.20-2.5. Individual refill inserts are also available.

For more information, visit [www.afs-fix.com](http://www.afs-fix.com)  
Alcoa Fastening Systems



## CHAIN ACCESSORIES



Porter-Ferguson offers a complete line of rugged accessories for use with 3/8-inch chain that can make set-ups and changes faster in any pulling system. With the CA0156 Quick Hitch, a tech can quickly and easily attach two chains without having to add a grab hook. There are three catches. The CA0157 Quick Catch speeds up the grab process by eliminating the need for a hook as does the CA0166 Single Chain catch, which also eliminates the problem of twisting that often occurs when using a grab hook. The CA0167 Double Chain Catch lets a tech quickly and easily shorten a chain, or hook two chains together.

For more information, visit [www.lowellcorp.com](http://www.lowellcorp.com)  
Porter-Ferguson

## MOBILE WHEEL LIFT

The new MW-200 Mobile Wheel Lift was designed to take the worry out of the wheel removal and installation process. The MW-200 features three large rollers for holding and rotating wheels and tires weighing up to 200 lbs. The rollers allow the technician to align the wheel and hub without straining to hold a heavy load. The lift has a 6-second rise time to keep the repair process moving at a quick pace. To use the MW-200, the operator simply connects the included air hose to a compressor capable of providing 100 psi. Its single-lever control allows for quick operation and an additional air tool hookup on the column reduces the number of hoses running through the shop. A tray for parts and tools is mounted on the column to keep everything organized.



For more information, visit [www.rotarylif.com](http://www.rotarylif.com)  
Rotary Lift

## CABINET DISPLAY AND MINI LAMPS

Federal-Mogul's Wagner Lighting brand offers a new cabinet display and product assortment for vehicle service businesses. Wagner offers a comprehensive line of original equipment-quality standard and "Long Life" mini lamps that cover virtually every popular late-model domestic or foreign nameplate vehicle, as well as commercial vehicle, marine, ATV, snowmobile, motorcycle and aircraft applications. The new Wagner mini-lamp cabinet merchandiser (No. TLF34) features colorful, consumer-oriented graphics, a strong metal door with magnet clasp for secure storage, and nine shelves — along with magnetic labels to help shops effectively organize and display their lamp inventories. The powder-coated, 24-gage cabinet can be easily mounted to a wall or placed on any flat surface in or near the repair bay. The Wagner TLF34 assortment/cabinet includes nearly 150 miniature and driving lamps covering many of today's most popular vehicle models.



For more information, visit

[www.federalmogul.com](http://www.federalmogul.com)

Federal-Mogul

## SOFTWARE UPGRADE

The new Software Upgrade 13.4 from Snap-on Diagnostics is packed with high-performance diagnostics. With the most current diagnostic capabilities for more than 64 million vehicles on the road today, the company says, this powerful upgrade expands repair shops' service reach by delivering the latest features and new coverage for all major makes back to model year 1998. Its optional European coverage introduces all-new FIAT® 500 coverage for engine, transmission, ABS, airbag, body control, instrument, electric power steering and more. Plus, technicians can service more cars with the new 2013 domestic and Asian coverage for GM, Infiniti, Lexus, Mazda, Nissan, Scion, Subaru, Suzuki and Toyota. This new software upgrade is available to all VERUS, VERDICT, MODIS, SOLUS, ETHOS Families and Vantage PRO owners.



For more information, visit

[www1.snapon.com/diagnostics/us/Software](http://www1.snapon.com/diagnostics/us/Software)

Snap-on Tools Co.

## DRIVETRAIN KITS

SKF has added 18 new part numbers to its line of differential kits. The new part numbers, available in either a standard kit (prefix



SDK) or master kit (suffix MK), include a range of rear differential kits for Chevy/GMC, Cadillac, Dodge and Ford applications. Standard differential kits from SKF contain all the components needed for a complete repair, including: pinion bearings, differential bearings, pinion seal, pinion nut, crush sleeve (where applicable), gear marking compound and brush, thread locker and silicone sealant. Master differential kits contain all of the elements that come with the standard kits as well as pinion shims (where applicable), pinion adjusting shims, differential shims and ring gear bolts.

For more information, visit

[www.skf.com](http://www.skf.com)

SKF

## OPEN-TO-LOCK DIFFERENTIAL

Auburn's new electronic open-to-lock differentials offer case strength and exclusive gear geometry. Dependable electronic operation allows the driver to conveniently transition from an open to a locked differential mode as the need arises, all without leaving the driver's seat, the company says. They were designed to instill confidence by eliminating the gear and pneumatic system failures that have been known to occur among those asking more of their Dana 60 axles and aftermarket selectable lockers. Auburn created its new differential in response to marketplace demand for a more reliable solution and to consumer dissatisfaction with the status quo.



For more information, visit

[www.auburngear.com](http://www.auburngear.com)

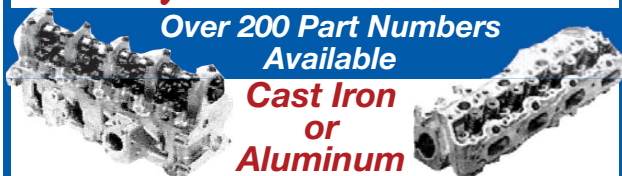
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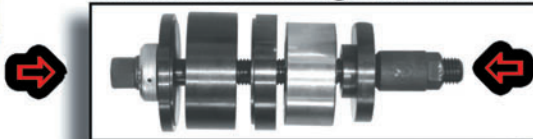
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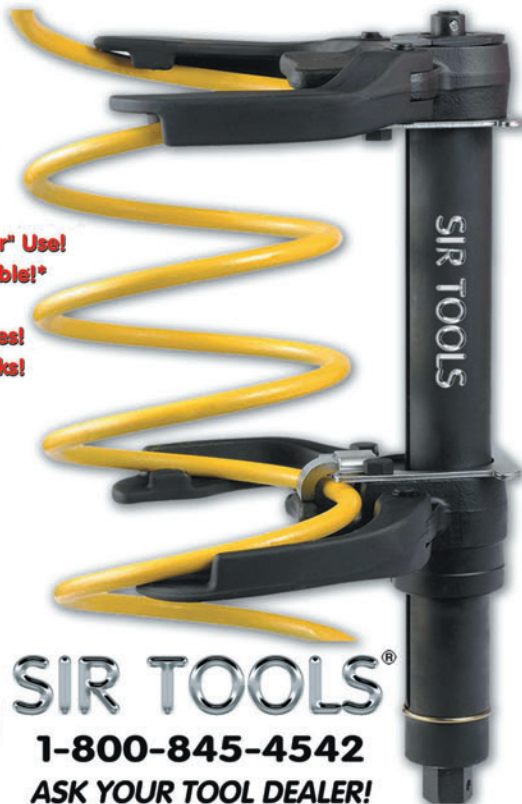
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# THE HEART OF THE MATTER

THE A/C COMPRESSOR IS THE HEART OF THE AIR CONDITIONING SYSTEM. TAKE CARE OF IT, AND IT WILL LAST A LIFETIME.

BY **PETE MEIER**

**Technical Editor**

Air conditioning systems have come a long way in a short while. Today's systems are more efficient, more durable and more capable of keeping the vehicle's occupants comfortable even in the hottest of our nation's cities. According to a recent report delivered at the annual Mobile Air Conditioning Society's (MACS) training event and trade show earlier this year, compressor failures made up only a small portion of the total A/C system repair business as reported by member respondents.

And while the instances of compressor failures have gone down, other problems in the air conditioning system can put the compressor in jeopardy. Leaks, for instance, will lead to lower refrigerant levels and that can impact compressor lubrication. Clogged condensers might produce excessive heat in the compressor, similar to how a clogged radiator will lead to engine overheating.

Failure to properly repair these problems correctly also can make life harder for the compressor. Overcharging the system with refrigerant, or allowing air to remain in the system when recharging, can cause higher head pressures and heat — both bad things for the A/C system's heart. Adding too much or too little oil, or overdoing the system with leak detection dyes, can have the



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same effect as it does on its gasoline-powered brother.

Should a compressor fail catastrophically for whatever reason, failure to follow the correct replacement procedures (like getting all of the old debris out of the system or adding inline filters as required) almost assuredly will mean that your customer will soon be back with another failed pump.

Yes, compressors on modern cars are robust units that can last the life of the vehicle. But problems in the rest of the air conditioning system and the improper repair of those problems can cause premature, and unnecessary, failure. Making sure the "heart" of your customer's air conditioning sys-

tem stays healthy is the topic for this month's edition of the Motor Age video series, The Trainer. *TM*

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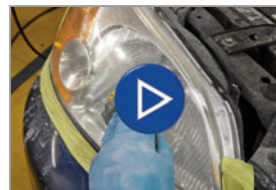
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