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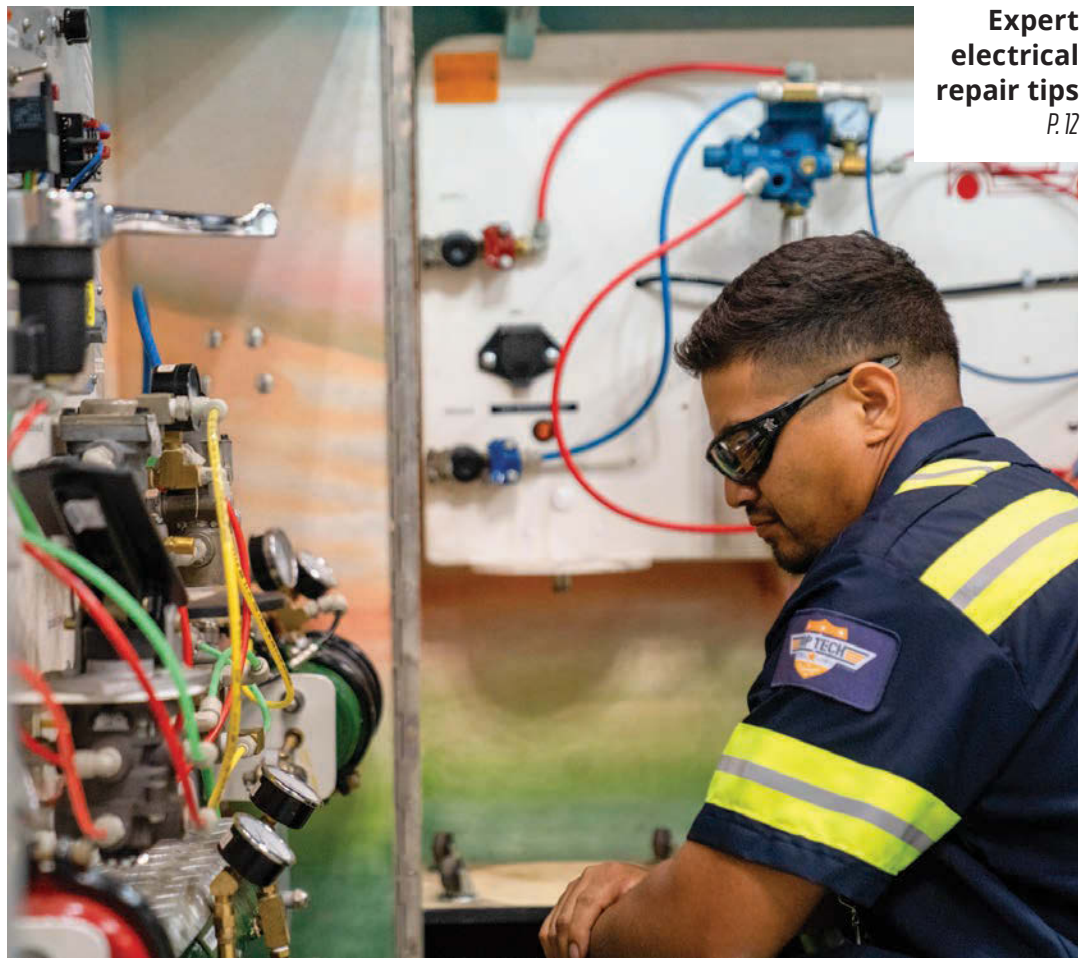

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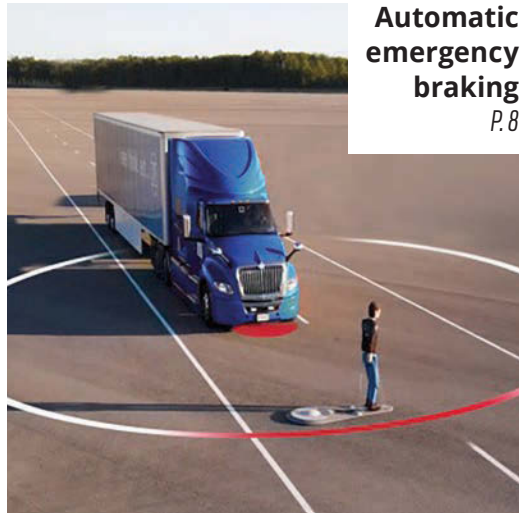

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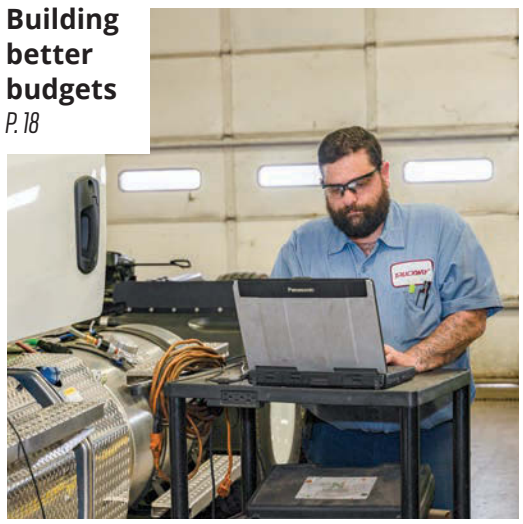

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FROM THE EDITOR

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John Hitch | Fleet Maintenance

ARTICLE

Focus on training and competition a winning combo for Penske

Penske Truck Leasing is a leading provider of rental and leased trucks, while Team Penske routinely tops the leaderboards in NASCAR and IndyCar. On June 8, both sides came together at the sprawling and secretive Team Penske Race Shop.
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ARTICLE

Ford technology, versatility now Super Duty-sized for 2023

The 2023 F-Series Super Duty is packed with technology and power, offering fleets a safe, versatile vehicle. Being fun to drive doesn't hurt, either.
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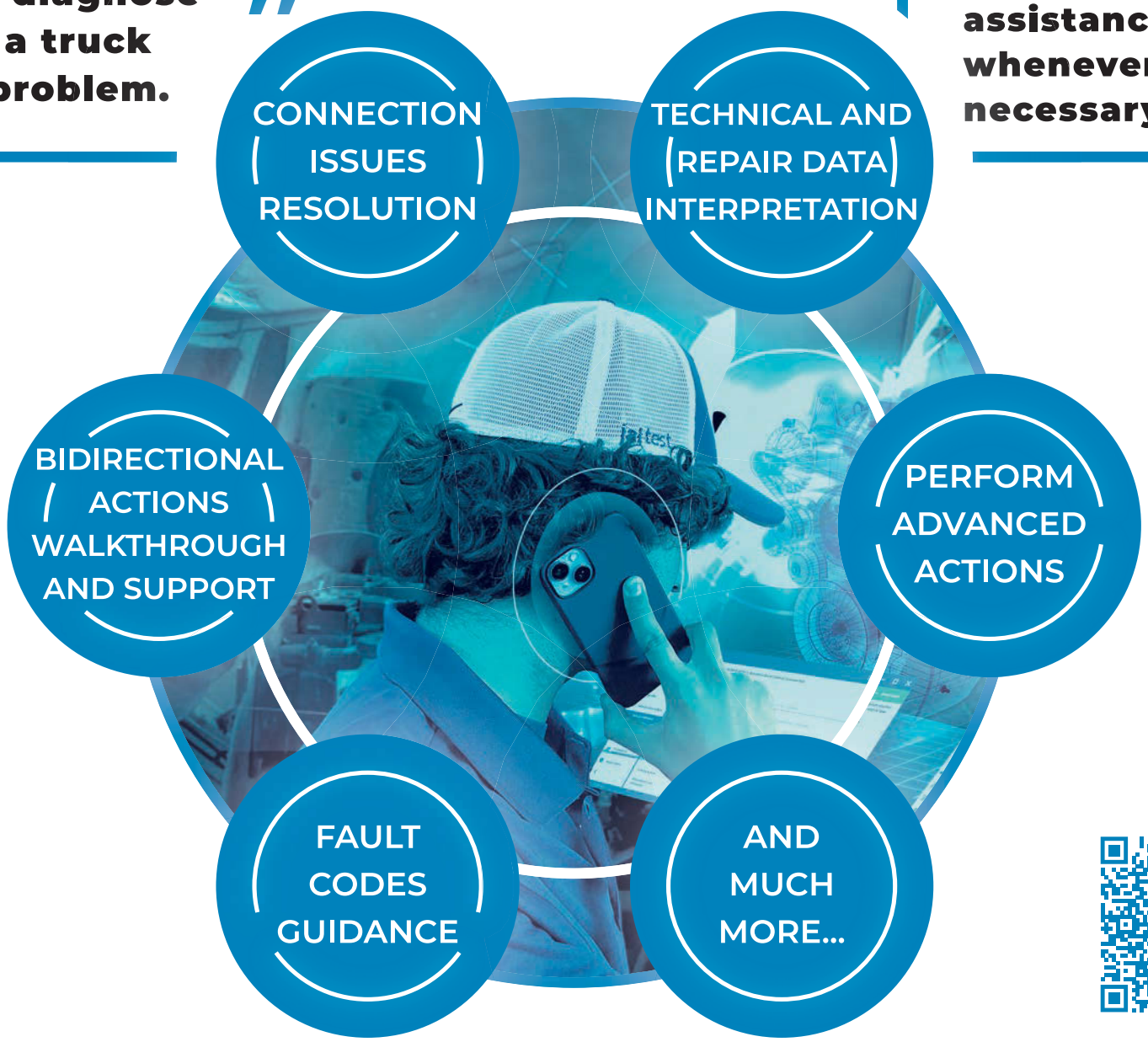

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SCAN CODE

Using AI without losing what's important to your business

The transportation industry is undergoing some serious changes, with more AI solutions nearing reality. What will that mean for fleets' biological intelligence?

By John Hitch
Editor-in-chief

@Hitched2Trucks

In June, I traveled out of state three times to cover three extremely different events. It was an equally exhausting and informative month.

First was Penske Truck Leasing's National Tech Showdown in Mooresville, North Carolina. The competition is Penske's diagnostic-heavy version of TMCSuperTech and was held in Team Penske's Race Shop. Watching a bunch of dudes swap between standing at a laptop and climbing inside a Freightliner cab for 40 minutes was not as riveting for a spectator as watching Team Penske's pit crew change an Indy car's tires and fuel tank in under 10 seconds. Still, the trip to the world-class facility was extremely beneficial.

Aside from the cool factor of touring the various departments, including the secretive Porsche Penske Motorsport wing, the gym where the pit crews train, and inside the specialty trailers, I got a chance to see hard-working diesel technicians being treated like royalty. Mind you, Team Penske less than two weeks prior had won both the Indy 500 and NASCAR Coca-Cola 600, but at least for a day, the 16 technicians (who beat out more than 1,600 colleagues) were able to take a victory lap.

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And they deserve it, as uptime is the main selling point to Penske customers, and that's what the company's 10,900 techs provide. Art Vallely, president of Penske Truck Leasing, made that point clear during the awards ceremony.

"You're the number one group—the group that is responsible for our revenue growth in the company," Art Vallely said to the finalists. He also told them they would get even more VIP treatment at the Indy 500 in 2024.

The next week, *Fleet Maintenance* Associate Editor Cris Beaulieu and I drove from Cleveland before dawn to Romeo, Michigan, home of the Ford Michigan Proving Grounds, to test-drive the 2023 F-Series Super Duty. Rambling along the winding roads towing 30,000 lbs. gave me an appreciation for the drivers who do the job every day. The advanced driver assist system (ADAS) features, such as Blind Spot Information System, meanwhile, gave me an appreciation for the latest technology they cram into these trucks. Cameras on the trailer provide a split-screen view on the dash infotainment screen to show the trailer was still on the road during wide turns.

Among many innovations, Super Duty owners can now take advantage of Pro Trailer Hitch Assist, and it helped this Hitch like a pro. The truck locates the trailer hitch (if it's within 20 feet), uses artificial intelligence to calculate the correct angle of approach, and autonomously does the hard work for you. It worked perfectly, though I still don't think autonomous trucks will hit widescale adoption anytime soon.

There will always be the folks who prefer to do things the manual way, but having the machine do certain jobs for you does ensure speed and accuracy. There's no shame in it. Honestly. It would be like me deriding you for using Grammarly or spell check (both of which even I occasionally use for quability assurance). And someday I'll probably have ChatGPT write this column for me.

Putting more technology onboard means more data, and Ford Pro is growing its telematics ecosystem (30% of Ford's 12 million commercial vehicles in operation have modems) to harness that data. This opens the door to more predictive maintenance, which is a bit like ADAS for the maintenance side. Just as automatic emergency braking engages even if you don't see the vehicle ahead, predictive maintenance algorithms will detect when service, like an oil change, is needed due to remaining oil life, or if a serious issue could threaten uptime.

"We'll know in advance, we can order the parts in advance, and they could be there to effect the repair when you come through," explained Tim Baughman, Ford Pro general manager. "And this is where we're heading."

The next Wednesday, I was headed to Austin, Texas, for Samsara's Beyond '23 conference. One of the first things Samsara CEO Sanjit Biswas talked about was how the acceleration of technology is growing exponentially. It took 15 years to get from zero to 100 million PCs and two years to get from zero to 100 million smartphones, he explained. More recently, ChatGPT was adopted by 100 million people in only two months.

It's hard to forecast all the ways transformative technology will impact society, but here's something to ponder. If you wanted to design a website or post a blog 20 years ago, you had to learn HTML. Now it's all drag-and-drop and anyone can do it. AI will likely head the same way. It's not a stretch to imagine a shop AI assistant (ChatDTC?) that can access millions of work order histories and instantly diagnose the problem, automatically order parts, schedule repairs, and assign the technician.

After hearing about how Samsara is making third-party data integration easier, and talking with several of the telematics company's partners, this is on the horizon. Does this spell the end of diagnostic techs and even shop supervisors? Hopefully not.

Biswas envisions AI will serve as a "co-pilot" for fleet managers, sharing the cognitive load, if you will. That is certainly a possibility. It's more likely than robots taking over the shop anytime soon.

With all my recent travel, I sure wish I had an AI helper to help me catch up and answer emails and proof copy. But at what point do we give up too much and lose purpose? Diagnostic technicians like Missy Albin (pg. 26) love the problem-solving aspect of CV maintenance. Would the industry attract great people like her if AI did 90% of the work, or would it attract only people willing to do 10% of the work?

I don't have the answer, but what I have learned from all these visits is that technology should be treated like a tool, not a cure. AI will make things faster and easier for you, as well as your competitors. What will define your success is still the same as always: your workers and how you can support them.

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AEB ADOPTION

Automatic emergency braking systems are becoming more common in the commercial vehicle industry, but are efforts to mandate the tech moving too fast?

By Alex Keenan

[SAFETY]

When it comes to autonomous vehicles (AVs), the question isn't if we'll be sharing the road with them one day, but when. As it turns out, recent developments indicate that 'when' could be soon. Loadsmith recently purchased 800 trucks outfitted with Kodiak Driver, a long-haul self-driving vehicle system. In January, TuSimple also started testing its Level 4 autonomous trucks, which require no human interaction but can be overridden by a driver, in Japan. And Waymo and Aurora have been piloting their technology to deliver freight around Texas as well.

But before a significant number of AVs hit the road, the public must trust they won't malfunction and cause a crash. This is where automatic emergency braking systems (AEBs) come in.

These systems use radar, lidar, and cameras to detect objects in front of a vehicle, and if an object or vehicle is too close, the system takes proactive measures to avoid a collision. Because of the obvious safety benefits, they are growing in popularity among fleets.

And, overall, AEBs have worked very well in terms of safety, with a 2020 report from the Federal Motor Carrier Safety Administration (FMCSA) predicting that if widely implemented, this technology could prevent 31-37% of heavy-vehicle front-to-rear crashes. In June, FMCSA proposed a rule that will require AEBs on all new Class 3-8 commercial vehicles. This could go into effect as early as 2027 for heavy-duty and medium-duty vehicles by 2028.

The National Highway Traffic Safety Administration (NHTSA) estimates the proposed rule would prevent 19,118 crashes, 155 fatalities, and 8,814 injuries per year. A 2022 NHTSA study found that vehicles equipped with AEB and forward-collision warning technologies cut crash frequency in half.

The rule has also gained the support of the American Trucking Associations. "The trucking industry supports the use of proven safety technology like automatic emergency braking," asserted Dan Horvath, ATA VP of safety policy.

The reason so many groups are behind the technology is because it lessens the impact of human error.

SPEEDS AHEAD

"Humans are fallible. Sometimes truck drivers are distracted or fatigued," noted Zach Cahalan, executive director of the Truck Safety Coalition. "AEB is effective even when humans make mistakes. This is a slam dunk for roadway safety."

But that doesn't mean that this technology cannot also make mistakes. Even though AEB is generally proven to be safe and reduce accidents on the road, at times the technology can act unpredictably.

NHTSA has investigated complaints of AEBs exhibiting 'phantom braking,' or incidents where the system brakes hard, without warning, and seemingly at random. When *Fleet Maintenance* reached out to AEB manufacturers to discuss this phenomenon, none wished to provide specific comment on the matter

While OEMs and fleet leadership tout the safety benefits of AEB, intermittent issues such as phantom braking can put a wedge between fleet management and drivers.

"Fleets need to take driver complaints about these systems very seriously because they can cause a lot of issues," said Daryl Bear, COO and lead engineer of Mesilla Valley Transportation Solutions (MVTS).

Though safety and trucking organizations agree that AEBs are successful and should be mandated, drivers and testing facilities aren't convinced. This makes it all the more important to explore these systems, how to service them, and where they need to improve.

How AEB works

At its highest level, AEB is meant to account for human limitations. For instance, if a driver is distracted or has trouble seeing a vehicle ahead, the AEB provides an alert, a feature that some fleets have found useful for training purposes.

"The presence of automatic braking systems has increased driver awareness of their technique by alerting them to the reality of how close they are to an impending accident," said James D. Moore, Ryder senior manager of technical maintenance support. "Over the course of a long day and in all traffic and weather conditions, the automated systems provide 100% efficiency to allow safe operation, even when the conditions are challenging."

AEBs do this by reducing the engine's throttle, applying the engine retarder, and then partially or completely engaging a vehicle's foundation brakes, all while providing the driver with a dashboard alert if it detects an impending collision. Some examples in use today include Bendix Wingman Fusion, Detroit Assurance, Volvo Active Driver Assist, and ZF OnGuardACTIVE. While they were developed with different manufacturers, all of these systems integrate with several parts of the vehicle, including the air lines, engines, transmissions, and brakes.

"When the AEB system determines it must override the operator and apply the brakes due to a safety concern, the system will communicate to the air brake valve and open it," said Joe Kay, director of engineering, Cummins-Meritor. "This allows air to flow to the foundation brake, thus applying the brake."

This air system engagement also requires deep connectivity between AEB systems, stability controls, and anti-lock braking systems for proper functionality.

» While many vehicles benefit from AEBs, autonomous vehicles especially do so as a safety failsafe.
Kodiak Robotics

"There is some deceleration tuning that occurs within the stability control system to compensate for differences in the foundation brake system, so OnGuard can request specific amounts of deceleration, and the stability control system does the rest," said Chuck Brodie, field service team leader, CV Solutions, ZF. "After that, we have to work with the engine controller so that we can derate it during CMS events or control the torque when ACC needs to adjust for a slower lead vehicle."

AEBs work similarly with the transmission, allowing the former to recognize when the latter shifts so it can compensate for neutral coast features.

» ZF's next-gen OnGuardMAX AEB system integrates several camera features into one device to avoid cluttering the windshield without losing any of its safety features.

ZF

AEBs and maintenance

Since this technology works with so many other systems in a truck, any technician working on or servicing AEBs must be prepared to use a holistic maintenance approach that takes this interconnectivity into account. However, many AEB providers have said that recalibrating and diagnosing these systems is usually not done by a technician, but by the system itself.

"For OnGuard, a simple road test is all that is needed to make sure everything is working correctly," Brodie affirmed. "If there are any issues, the system sets fault codes and lets [technicians] know via the HMI."

During a public road test, Brodie explained, OnGuard attunes itself to the traffic and roadside objects, aligning the radar.

Detroit Assurance works similarly, explained Len Copeland, Detroit Products marketing manager, Daimler Truck North America. During a technician road test, Copeland said that Detroit Assurance is "learning its location on the vehicle relative to the camera on the radar" in a calibration process that "happens almost automatically."

If the road test fails, then the technician needs to inspect the radar bracket, which may be bent and need repairs, or the system cameras, which may be blocked. "Watch where people might naturally place their foot when tilting a hood so as to not damage the module," Ryder's Moore warned. "Also ensure [that the radar] brackets are sturdy and not susceptible to vibration."

Beyond these mechanical solutions, TJ Thomas, director of marketing and customer solutions at Bendix, did not recommend technicians test AEB functionality without the use of specialized testing equipment and a trained driver.

"Beyond that, drivers and technicians should follow the information on the vehicle dash or ACom PRO for further diagnosing, troubleshooting, or calibrating," Thomas advised, referencing Bendix's diagnostic software.

However, fleets utilizing AEBs have also noted that maintaining these systems requires extra care for a vehicle's electrical connections.

"It's critical to focus on wiring integrity and connections," Ryder's Moore emphasized. "Pay close attention to wiring connectors, and protect them from corrosion and damage."

Limitations and concerns

While AEBs have come a long way and the industry generally agrees that they work well, problems have arisen. In one recent example, 18 Freightliner Cascadia (MY 2017-2022) trucks equipped with Detroit Assurance experienced sudden, unexpected stops. This led to a NHTSA investigation on these "false positive events." During the Office of Defects Investigation, NHTSA duplicated the unintended braking event during a "steel trench plate" scenario.

When asked for comment, a Daimler spokesperson stated that they are committed to the safety potential of AEBs and share the same mission as NHTSA, and they will continue to work with the agency to review AEB technology and upcoming regulations and tests. The probe could involve up to 250,000 AEB-equipped Cascadias (MY 2017-2022).

If this were the only case of driver difficulties with AEBs, 18 Freightliners might not make for much news. MVTS has experienced similar situations while testing vehicles with AEBs, but the make and model of both were not disclosed for legal reasons.

"We've had situations where the system would malfunction randomly and lock the brakes so bad that it actually flat-spotted the steer tires," MVTS's Bear said. "When we first got this vehicle, it shook a lot. And then when we switched the tires, it got better. But then this braking issue happened, and it flat-spotted the second set of tires, and we realized what had happened to the first set."

Incidents like these have done nothing to engender driver confidence in AEBs, a sentiment that was echoed at Shell Rotella's SuperRigs 2023 truck show held in Gillette, Wyoming, this past June.

"I'm not a fan of [AEBs]," said Nichole Cheek, a driver for North Country Logistics. "For one, I think it's dangerous. If an emergency or something like that happens and you can't get the truck off the road, then what? You're impeding traffic, you can cause a wreck, or somebody can get injured."

Barry Kasdorf of Jade Transportation worried that sensors trumping a driver's skills could lead to disaster as well.

"If you went into a corner, [and the system] thought you're going too fast, it would throw the brakes on," Kasdorf explained. "I've never had it happen in adverse weather with snow and ice, but I don't think you'd want that. It would throw you into a skid."

The future of automatic emergency braking

Despite occasional imperfections, manufacturers are still working hard to improve AEB technology and incorporate it into new applications. These improvements may come in the form of increasing the accuracy of sensors and cameras.

"Detection range, picture resolution, and night vision may be improved with better hardware and sensor quality," said Dirk Wohltmann, director of engineering for the Americas, Commercial Vehicle Solutions, ZF. "New processor technology can also increase update rates, and increased storage capacity helps to store and process better quality pictures."

Brett Suma, CEO and founder of Loadsmith, noted that AEB technology serves as a safety redundancy for people, especially when it comes to driving in severe weather. Suma explained that a human driver might decide to get on the road where a driverless truck might choose to stay put. AEBs could help mitgate the human's risky choice.

"For the people that have a hesitancy about it, every day technology gets better, every day sensors get better," Suma added.

These extra precautions also become a failsafe for AVs, a necessity when the ultimate goal is to remove the human fallibility from commercial vehicles entirely. Someday, AVs may not need a last line of defense.

"Eventually, if we can show that [AEB] is not needed and the federal government agrees and grants exemption, we wouldn't need to put them on," Kodiak CTO Andreas Wendel said. "But at the moment, they do provide a really good baseline."

This means that Kodiak's Kenworth T-680s equipped with Bendix Wingman Fusion and Kodiak Driver work within the same parameters that a human driver would. And part of the reason AVs are likely to keep this baseline is because AEB technology has already been thoroughly tested.

"They have also been tested for many miles, and there's good data behind them," Wendel explained. "Safety is our number one priority, so having these systems on at the moment doesn't hurt us. It helps us overall, and that's why we'll have them on for the foreseeable future."

As for AEB systems in general?

"Imagine a situation where a human driver fails to take action, then the automated emergency braking system actually jumps in and corrects for that mistake," Wendel said. "If you look at it from a safety envelope, it is great if even in 10% of these situations, the AEB system saves the day. That is a net positive."

Every fleet will need to come to its own conclusions on whether AEBs are right for them and their drivers. But it seems likely that the number of AEB systems in the commercial vehicle market will only continue to grow, as the technology's life-saving potential is well worth stumbling over a few speedbumps along the way.

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Bright ideas

to speed up lighting and electrical repairs

Experts offer tips to help solve common and uncommon electrical and lighting issues on commercial vehicles.

By Seth Skydel

[WIRING ELECTRICAL]

Lighting and electrical system repairs on trucks, tractors, and trailers are a high priority for service operations due to their impact on safety and uptime. The maintainers of fleets must be lightning quick when trying to figure out why a trailer light is out and how to fix it in order to avoid a CSA violation. At the same time, tests and diagnostic procedures required to speed up repairs can be time-consuming and highly detailed.

Fortunately, technical experts and experienced technicians across the industry have developed best practices and tools to improve the speed and accuracy of electrical and lighting repairs. What follows is a series of tips that detail procedures these subject-matter experts have found effective to facilitate the diagnosis and repair of these vital systems.

» First, always determine if a circuit is power- or ground-side switched.

Cox Automotive

Identifying electrical and electronic faults

There are three faults to look out for in electrical and most electronic circuits, noted Terry Rivers, senior manager of vehicle services training, Cox Automotive Mobility Fleet Services.

These include:

High Resistance: This is the opposition to the flow of an electric current. "If there is no current flow, then there's no resistance, which also means no voltage drop," Rivers said. "Typically, you would diagnose this high resistance fault with a voltmeter. Today, you could diagnose this with an infrared temperature gun or a thermal infrared camera." This is the most common fault.

Open Circuit: This is caused by an electrical circuit that is not complete due to a break in the wire, a spread terminal pin, or an interrupted circuit. This is the second-most common fault.

Short Circuit: This is an undesirable condition where the current travels along an unintended path with little to no impedance. "This will lead to the circuit being on all the time with the switch off when there is no blown circuit protection (fuse), or the circuit being off all the time even with the switch on with blown circuit protection," Rivers said. This is the least common fault.

The first and most important step is to determine if a circuit is power- or ground-side switched. If it is a power-side switched circuit and the customer complains the dome light stays on all the time, it's impossible for this to be an issue on the ground side. Secondly, determine inputs, processing, and outputs. These steps can reduce the length of wire you need to find the fault.

Effectively using a digital multimeter

Use a digital multimeter to test voltage when a lamp or other electrical component is operating at a reduced output, noted Dean Kennedy, corporate training manager, Aim NationaLease. "If the voltage available at the device in question during operation is not equivalent to the supply voltage, begin troubleshooting the circuit traveling upstream toward the source," he said. "Once you locate the point in the circuit where supply voltage is present, you can further isolate the root cause.

"Using your DMM on a voltage scale, begin comparing two points in the circuit," Kennedy went on. "Connect one lead to the location where you earlier measured supply voltage and the other lead downstream toward the device where

"A multimeter is a better tool because it will tell you if you have the right voltage, not just whether or not voltage is present."

Dan Miller, field service manager, Peterson Manufacturing

1306312562 | Andrii Atanov | Getty Images

» Check fuses and relays whenever you have circuit issues to ensure that nothing has blown or is faulty.

Diesel Laptops

Streamlining electrical system repairs

According to Michael Whitman, director of product management at Optronics International, here are some tips to help you streamline the process and accuracy of electrical and lighting system repairs:

UNDERSTAND COMMON PROBLEMS AND SYMPTOMS

- Dim or flickering lights indicate a potential issue with the battery, alternator, or wiring connections.
- Total loss of lights could be due to a blown fuse, faulty switch, or broken wiring.
- Intermittent electrical issues suggest loose or corroded connections, damaged wiring, or a faulty component.
- Faulty turn signals or brake lights may point to a malfunctioning relay, broken wiring, or a defective bulb.
- Wiring and harness problems usually come in three categories, each with its own signs and troubleshooting procedures to follow:
  - » Failure due to a grounded circuit
  - » Failure due to an open circuit
  - » Failure due to a short circuit

DIAGNOSTIC PROCEDURES

Step 1: Gather information and perform a visual inspection, interview the driver to understand the symptoms and any recent changes they may have observed, and inspect the affected lighting system components, looking for visible damage, loose connections, or signs of overheating.

Step 2: Test the power source using a multimeter to measure battery voltage and check for proper charging from the alternator, ensure battery terminals are clean and secure.

Step 3: Check the fuses and relays using a circuit tester or test light to check for blown fuses or faulty relays.

Step 4: Inspect wiring and connectors for damage, loose connections, or corrosion. Look for wires and cables that are bent sharply and those that contact metal edges, such as where wires pass through walls or into body cavities. Use a multimeter to check for continuity and measure resistance.

Step 5: Test the lighting components, using a test light or multimeter to check if power is reaching the bulbs and connectors.

"Remember to consult the service manual or wiring diagrams for the vehicle you are working on as procedures and electrical system designs can vary," Whitman concluded.

» A digital multimeter is key to diagnosing an electrical component with reduced output.

Diesel Laptops

reduced supply voltage was noted. Using this method, you can isolate the portion of the harness causing the voltage drop."

Do no harm while diagnosing

Corrosion occurs when moisture enters at points such as connectors, damaged wires, or improperly repaired wires and spreads, shorting out the light, related Dan Miller, field service manager, Peterson Manufacturing. "One of the common ways moisture enters wiring is during diagnostic testing when technicians use a piercing probe that can create an open path for moisture to enter the wiring.

"A multimeter is a better tool because it will tell you if you have the right voltage, not just whether or not voltage is present," Miller continued. "When a tech goes through troubleshooting steps, voltage information will be available with the use of the multimeter."

Intermittent turn signal failure

With an oscilloscope, noted Michael Eilbracht, trainer, Diesel Laptops, you can look at multiple circuits at the same time, which gives you a better chance of finding faults faster.

"For example, let's say a bus comes in with a complaint of left turn signals working intermittently," Eilbracht offered. "In this case, the turn signals are multiplex controlled, meaning a module controls how long the turn signals are on and off. Using three low-amp probes with three wires in each, turn on the left turn signals and look at the currents coming from the clamps. The one channel that has the most current is the culprit."

Voltage drop test procedures

In situations where the wiring is not contained in a sealed harness and you are able to access both the positive and ground circuits, you can use a multimeter to determine voltage drop, related Andrew Summers, director of fleet sales at Phillips Industries.

"First take the voltage on the positive side wiring from the power source to the component to read voltage drop," Summers continued. "Check the allowable drop for the size and length of wiring you are testing and if the reading is outside this range, work your way back between connections until you find the section of wire where the issue is located."

If no problems are found, Summers said to repeat the test on the ground side starting at the main ground for the component and working your way through the ground path. "Pay special attention to any frame grounds, as corrosion, paint under the connection, and loose connections can all create voltage drop," he advised. "If voltage drop is minimal on both sides of the circuit, then the issue is likely the component."

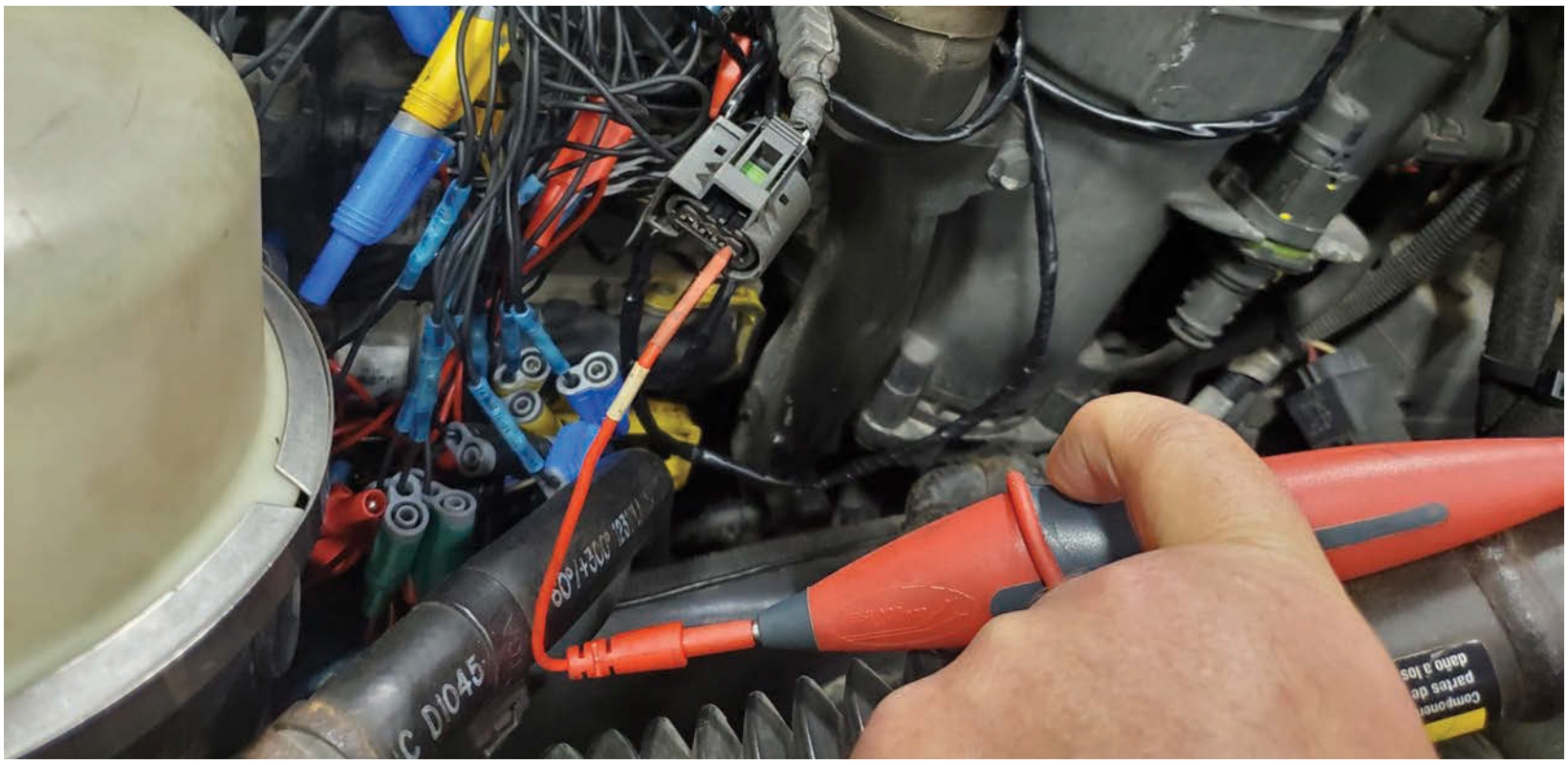
For voltage drop tests on a sealed harness system, Summers noted, use a multimeter to read the voltage at the power source for the component. On tractors, it will usually be at the batteries, the alternator, or power distribution panel. On trailers, unplug the 7-way cord at the trailer, and measure the voltage at the plug on the cable of the circuit you are testing (running lights, clearance, brake, etc.).

If the voltage is acceptable, then plug the cable back in.

NOTE: To determine how much voltage drop is acceptable in a cable, use an online calculator.

Diagnostic and repair steps

"Sometimes there is more wrong than has been reported, and it can help narrow down where the fault is located," said Phillip Pinter, sr. technician, FedEx Freight. "With most circuits having multiple lights attached, if more than one is having the issue, it allows for points of commonality to be looked at and get you closer to the problem."



» The purpose of electrical diagnostics is to ensure that technicians deal with the root cause of the problem, otherwise a quick fix may cause new issues.

Diesel Laptops

» A good electrical diagnostic kit needs more than just a digital multimeter. It should also include safety tools and hand tools.

Peterson Manufacturing

Electrical workstation essential tools

Here is a list of common tools that should be readily available to complete lighting repairs:

- Safety glasses and gloves
- Needle-nose and slip-joint pliers
- Wire strippers (10-24 gauge)
- Crimping tool
- Heat gun with shrink tubing (various sizes)
- Utility knife
- Multimeter
- 12V power supply
- High/low amp clamps
- Insulated splice with solder
- Electrical tape
- Potentiometers with different resistances to substitute sensor values
- TMC RP 186 Wire and Cable Repair Guidelines

To verify complaints, Pinter recommended hooking up the trailer to a tractor or a trailer testing unit and inspecting all lights. "If no other issues are found, use a multimeter and check for power and ground at the light," he said. "If either is missing, work your way back through the harness until the problem is found.

"If everything measures correctly with a meter, use a circuit loading device and verify the wiring can carry the load required," Pinter continued. "A partially damaged wire may give you correct readings when no load is on it but fail if trying to operate something. If the load test fails, move the ground to a known good spot and test again. If it still fails, the problem is in the power supply. If it passes, the issue is with the ground circuit."

Finally, Pinter said to use an external power supply to put energy directly to the light and verify if it operates.

Quick fixes are only a short-term solution

When lights go out on the road, a quick roadside fix may require butt connectors or terminals, noted Larry Rambeaux, sales application engineer, Purkeys. "However, generic connectors are prone to water intrusion and corrosion, so they need to be replaced," he said.

Rambeaux went on to provide an example of issues with roadside repairs involving liftgate charging systems:

A technician moves the wiring until they get a light and assumes it's working, but that doesn't mean the system is charging. In order to hurry the repair along, the technician may change the liftgate batteries, but if the charging system wasn't repaired, the new batteries will drain and cause another issue.

Follow established guidelines

Follow TMC RPs for effective diagnostic and repair procedures, Rambeaux advised, including several that show proper wire repair procedures, how to select the right kind of wires, etc. RPs also apply to setting up lighting and electrical repair workstations.

"If TMC RP repair procedure guidelines are followed," he added, "fleets can use them and established procedures to successfully repair electrical systems."

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BATTLE OF THE BULGING BUDGET

As shops are pushed to increase wages and upgrade tools and equipment, calculating budgets has become one of management's tougher challenges.

By Cris Beaulieu

hamzaturkkol | 1396139907 | Getty Images; 39509108 | Taesmileland | Dreamstime

When Milwaukee County Transit System's maintenance garage got a push from county officials to start electrifying their fleet, management knew it was time for some equipment upgrades to their shop.

Management's first concern was dealing with the significant weight capacity increase their lifts would need going from 13-ton diesel buses to 18-ton electric ones.

MCTS' Ron McCorkel, director of maintenance, and Dwyane Reese, deputy director of maintenance, went right to pricing new lifts that could hold the extra weight. And thanks to their budget strategy for capital improvements calculated every five years, they were able to purchase 14 Stertil-Koni in-ground telescopic piston DIAMONDLIFTs and 16 Mobile Column Lifts.

"We had to make sure that we invested in some equipment that would take us into the next 15-20 years and plan just in case the next group of buses gets heavier," McCorkel said.

No matter the size, all fleet maintenance operations must accurately estimate their budgets to keep up with changes in equipment and technology, as well as offer competitive wages to increasingly in-demand labor.

Tracking the known

Transervice Logistics uses a home-grown system that tracks the number and age of their assets, predictable and demand maintenance needs, and labor costs to calculate their budgets. One critical metric they track is wearable component replacement.

"We can look at brake pads and know what those parts cost today and calculate how often we will need to replace them over the life of the vehicle," said Michael Dominguez, VP of business operations at Transervice. "We do an analysis based on the number of miles the vehicle will operate each year, factoring for both normal wear and tear and severe conditions, the expected life span for the vehicle, and where it will be operated. We couple that with our manpower formulas for labor cost."

Focusing on part life also helps a shop reduce the incidents of emergency repairs, which lead to higher unexpected costs. That predictability helps manage a budget more effectively, according to Robert Ziemba, marketing lead at Decisiv, a provider of service relationship management solutions.

The company recently developed calculators to help predict revenue increases. Decisiv also focuses on optimizing repair events, which helps fleets avoid taking trucks back out of service and taking a hit on the revenue side. This helps both the cost management and revenue generation side of the budget, said Mark Wasilko, VP of marketing at Decisiv.

"A Decisiv calculator won't help budget, but it will remind you of the reason to do it," Wasilko said. "If you're on a platform and you're proactive, then you're optimizing the service scheduling and the work that you've done and more intelligently budgeting repairs."

Sometimes the best predictor of the future is to look at the past. Truckway Leasing, a full-service commercial leasing, rental, and maintenance provider, bases its maintenance budget on a percentage of revenue derived from historical costs.

Eric Silz, Truckway's maintenance manager, said that's easier said than done. Those historical costs have to contend with the low mileage rates they are forced to charge, skyrocketing dealer labor rates, and increased parts and tire costs. But in the rental and leasing world, the more units on the road, the more the revenue will increase.

A poorly planned budget has a direct effect on a shop's bottom line, ultimately impacting the employees, Silz said.

» **Truckway's maintenance manager, Eric Silz, said that even the newest tech software and the smartest accountants in the industry could not have budgeted for the unpredictable costs incurred in recent years, including the additional diagnostic laptops and software needed to troubleshoot the many different types of vehicles at each Truckway facility.**

Truckway

Current challenges in budgeting

Planning for new equipment

While Americans continue to pivot their spending for inflation, forecasting equipment sales specifically in today's equipment market remains challenging, Transervice's Dominguez explained.

Silz agreed, adding that even the newest tech software and the smartest accountants in the industry could not have budgeted for the unpredictable costs incurred in recent years, including the additional diagnostic laptops and software needed to troubleshoot the many different types of vehicles at each Truckway facility.

"A typical trucking company may run a fleet of 100 vehicles, all the same make and model trucks," Silz said. "In the leasing and contract maintenance business, we find ourselves

working on many different makes and models and having to be that chameleon when it comes to the equipment in our shops."

Silz said Truckway has increased its annual budget for laptops and OEM software in the past few years.

All fleets will have to consider these extra expenses, as the diagnostic tool-to-technician ratio will go from 4:1 to 2:1 in the next three years, according to Noregon, a provider of commercial vehicle diagnostic & repair software and data analytics solutions.

Transervice's budget challenges include equipment price changes, the lack of detailed information on electric vehicles and autonomous trucks, and AI coming into the industry, Dominguez said. Labor wages must be evaluated annually to remain competitive in the industry, he added.

Truckway has had to set aside some of its plans for new equipment, specifically trucks, and make do with what they already have, Silz said. Truck allocations and shortages in production are forcing fleets to operate their assets longer. In turn, running trucks past their prime drives up maintenance expenses.

On the other hand, Chuck Drews, product manager at Fleetio, a web-based fleet management software, encourages fleet managers to avoid making macroeconomics or global supply chain issues their primary focus, but instead use digital management technology to track and report data that is specific to their fleet .

"The biggest challenge for organizations is that they have no solution to enable decision-making," Drews said. "Maybe they're tracking on the spreadsheet, maybe they're on paper. They just have nothing to go into to extract that and make decisions with. The role and responsibility of fleet managers is not to be an analyst. So, it's just challenging for them to take their qualitative feedback about resourcing or budget constraints and then translate that to their leadership without data to support what they're saying."

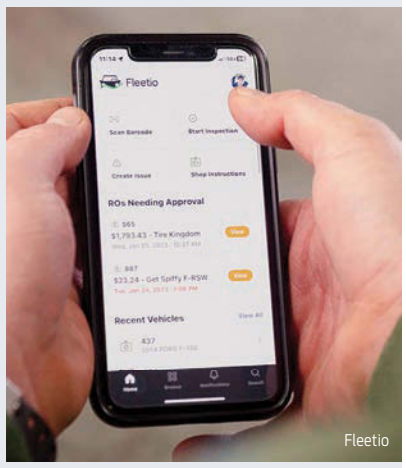
BUDGET BEST PRACTICES

Chuck Drews, product manager at Fleetio, offers five basics to consider when creating a maintenance budget:

1. **Develop a service program**: Have a system in place to create and track maintenance schedules for each asset within a fleet, including knowing at which mileage intervals it's going to perform them.

2. **Document estimated costs associated with each planned service:** Expected costs can always be updated later with actuals, but it's good to have planned maintenance cost estimates to start with.

3. **Understand each asset's forecast and usage for the timeframe that you're budgeting**: Predict which specific assets will actually hit those service intervals within the timeframe for which you're budgeting. For example, a single asset at the beginning of Q3 may have a maintenance event due every 10,000 miles. If there are 78,000 miles on the truck on day one and it travels an average of 200 miles per day with an expected 18,000 miles to be traveled in the next 90 days, managers could expect at least one maintenance event for this asset. Once the exercise is done for the whole fleet, managers can have a pretty good guess of planned maintenance costs throughout each month.



Fleetio

4. **Plan for the unplanned**: Estimate maintenance costs outside of what you have planned. For example, if a rock hits a windshield, that's an unexpected part failure. Building some leeway in the budget for unplanned repairs will help avoid surprises at the end of the quarter.

5. **Have a system for storing and analyzing the data in steps one through four:** The budgeting exercise itself could be recorded on spreadsheets and other business tools, but the tracking of maintenance schedules, vehicle mileage, odometer readings, and daily usage statistics should be housed in a fleet management system.

Longer downtime due to parts shortages

Truckway provides "Up-Time" service to their customers. This means that when their customers' truck goes down, Truckway will provide each customer with a replacement unit at no charge to them. The company does budget for "Up-Time" expenses, however, over the past several years, it has experienced an increase in downtime of their units due to parts shortages from the OEMs and labor shortages at the dealerships.

"We have had some instances where a truck was down for four months waiting on back-ordered parts," Silz said. "If a rental truck is being used for a replacement unit, this becomes lost revenue on the rental side of our business. This increased downtime has created a new challenge for our industry in the past two years."

Staying competitive during labor shortages

The challenges of finding talented labor and retaining techs have forced Truckway to increase wages by 16% in the last two years. That's up from a 3% annual wage increase in years past.

"Our biggest concern is finding talented labor," Silz said. "We spend a ton of money and energy recruiting new technicians while at the

same time doing our best to ensure we keep our current technicians happy."

Another challenge Truckway faces is not only finding good technicians but also finding good technicians that will work late shifts and weekends, catering to the needs of their customers who are on the roads 24/7.

"One of the things we have done to make the late shifts more appealing is to implement a larger per-hour shift differential," Silz explained. "This can be as much as a 20% increase in pay, based on their base wage."

Budgeting for EVs

For fleets looking to electrify, Fleetio's Drews encourages owners and managers to be realistic about how feasible that transition is for their business and consider their appetite for investment.

"Fleet managers should consider what level of charging infrastructure they have in their in-house facilities today," Drews said. "Is your organization prepared for the capital investment required to install all of these pieces of machinery and the ongoing uptick in the cost of electricity to support these?"

He also encourages fleet operators to get out and speak to other fleets in the process of electrification so they can understand the challenges they face, including a lack of charging locations and the associated downtime.

"It might be that there are lots of chargers close by, but they found that most of them aren't operating correctly," Drews said. "You would have to wait two hours just to be able to access the ones that are left over. Seeing how it works in the real world, that's a priceless base."

Silz believes the transition to electrification for his fleet won't happen anytime soon.

"Until the costs of electric vehicles come down, mileage ranges can be extended, and the infrastructure is put in place, this is a non-event for most of our customers at this time," Silz said. "I do believe the industry will eventually get this right, but only a few applications make sense right now. Yard spotters make a ton of sense to be electrified, as those vehicles can sit and charge all night and aren't expected to haul heavy loads over long distances. Also, local delivery truck fleets, buses, and postal service all haul lighter loads and have predictable downtime."

MCTS' McCorkel said that while fleets are dealing with the messy middle and multiple powertrains, it's best to stick to a single engine and a single transmission. This makes budgeting for training, tooling, and equipment easier for now.

"That narrows down what my staff has to be exposed to and not having a lot of different parts on their shelves," he said. "Our 344 buses are all Allison transmissions and all Cummins engines. That simplifies it."

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FleetMaintenance.com/shop-operations

Greasing: Manual or auto?

» The AECP (Automatic Electric Cartridge Pump) from SKF is installed on a vehicle or piece of equipment (as shown) to provide automatic, timed lubrication to 20-plus grease points. The AECP leverages standard grease tubes as opposed to incorporating a lubricant reservoir.
SKF Group

The pros and cons of manual grease guns, automated lubrication systems, and slick solutions that fall somewhere in between.

By Gregg Wartgow

There is no disputing the importance of ensuring all grease points on a commercial vehicle remain properly lubricated at all times. What's up for debate, though, is how to actually go about applying the grease. Manual, auto, or something in between?

One benefit of lubricating with a hand-operated grease gun is that the technician stays close to the vehicle.

"The ritual of greasing is an opportunity for inspection," said Jay Boren, president of LockNLube, a manufacturer of grease guns, couplers, and greasing accessories.

Using a manual grease gun also gives the technician a feel for how grease is moving into the fitting. Is the fitting taking grease easily, slowly, or not at all? Close proximity to that process helps determine if a fitting ever needs to be cleaned or replaced, for example.

Hand-greasing

As stated earlier, some fleets find hand-greasing does offer some benefits. Hand-greasing becomes even more appealing when the technician uses tools that make it easier.

The LockNLube Grease Coupler is one example. Bob Dietz & Sons, an excavation company in New Paltz, N.Y., has been using LockNLube couplers for years. Brian Dietz, co-owner, said they put them on every grease gun they have to lubricate their entire fleet of trucks and off-road equipment.

"Lubrication is just one of those things that's a real hassle," Dietz said. "Using LockNLube tips on our grease guns has totally transformed the process. Greasing is easier, faster, and cleaner. It's also safer and more efficient because it becomes a one-handed process. You can even push grease into fittings that have been somewhat resistant."

Dietz & Sons uses a mix of lever-action and pistol-grip grease guns, as well as battery-operated tools. LockNLube's Boren said a lever-action grease gun provides additional power over a pistol-grip. A lever-action also provides more grease per stroke, reducing the time and effort required to grease each fitting. But the real key is the locking coupler.

"Without a good coupler, the technician is left wishing they had a third hand," Boren said. The LockNLube is designed to create a leak-free connection while also ensuring that the coupler remains aligned with the entry point of the zerk and doesn't pop off under pressure.

"To release a LockNLube coupler, the technician pushes down on the thumb lever and pulls straight back," Boren explained. "Traditional couplers must be forced off to the side at a 15- or 20-degree angle, which can create issues with recessed fittings and other tight spaces."

For these reasons, some fleets appreciate the hands-on approach to greasing. They also like the minimal upfront investment, as well as the fact that "weekly greasing" provides a sense of security. But there's more to consider than simply the volume of grease being pumped into a fitting on a weekly basis. It's how long that grease lasts.

This is where an automated solution may provide an additional level of protection.

How an automated system works

To gain the efficiency benefits of an automated lubrication system, a fleet must spec the right system size for a given vehicle and application. But first, let's look at how an automated system is designed to function.

An automated greasing system is installed on the vehicle frame. Generally speaking, a pump distributes lubricant to different grease points through a series of hoses. Some sort of timer-based mechanism tells the pump when to send grease to a given grease point, along with how much.

Lubecore's Multi-Line Spyder comes in three sizes, with reservoirs large enough to hold roughly four to 13 lbs. of grease.

"It's important to match the grease reservoir capacity to the oil drain interval," said Jan Eisses, president of Lubecore International, a manufacturer of automated lubrication systems. For instance, the larger size could allow 14 grease points to be properly greased for 100,000 miles. But maybe the fleet doesn't need to go 100,000 miles. It's important to have this conversation with the lubrication system provider to choose the right option.

SKF has recently introduced an automated greasing system that is designed to make things even easier on the technician. "Anywhere you might normally use a grease gun is a good application for our new AECP (Automatic Electric Cartridge

Pump)," said Jordan Butler, product line manager for North American automatic lubrication systems at SKF Group, a manufacturer of lubrication equipment, bearings, seals, and other products.

The AECP draws its lubricant from a standard grease tube instead of a lubricant reservoir that needs to be occasionally refilled. That makes replenishing the system a little bit easier. According to Zach Cagle, strategic markets manager for mobile on-road at SKF Group, a tube of grease should last six to eight weeks under normal circumstances for a transport truck.

"We know certain grease points take certain amounts of grease," Cagle said. "You set up the AECP system's divider valve to deliver metered amounts of grease to the different fittings. It's all timer-based. How often you tell it to turn on is based on application. In a medium-duty vehicle with a lot of stops and starts, you might program it to come on every three or four hours. A heavy-duty vehicle might be every couple of hours."

Benefits of automated greasing

"Some of these fleets will tell you that they get really good component wear when greasing by hand," Eisses said. "It is true that frequency of lubrication is what gets you good component life. But those fleets doing it by hand every week are spending a lot of money on wasted grease, technician labor, and vehicle downtime. Also, every 3,000 miles (weekly) might not even be enough. You get component wear when a component goes dry, and that could happen at any time."

With an automated lubrication system, the technician is removed from the greasing process, saving labor costs.

There is also the issue of downtime. On vehicles with longer drain intervals, Eisses said the only reason to bring a vehicle in for service on some occasions is to grease it. With an automated system, the greasing takes place while the vehicle is in operation. That allows the vehicle to stay in operation until its next oil drain.

When a vehicle finally does come in for its scheduled service, Eisses said most technicians will be more than happy to trade in their grease gun for a flashlight to simply perform a thorough vehicle inspection. Part of that inspection now includes the automated lubrication system.

"Check for evidence of fresh grease around all grease points," Eisses advised. "Then you know the automated system's pump is working, and there aren't any broken lines. It's still a good idea to take a moment to inspect the lines for wear."

Lubecore has developed a payback calculator to help fleets factor in all of the benefits of switching to an automated system. Eisses said an automated system can help a fleet save roughly $2,000 per year when compared to hand-greasing a truck driving 100,000 miles per year. The automated system is expected to pay for itself in two years, and savings are estimated at more than $16,000 over an eight-year vehicle lifecycle. Additionally, Eisses said a fleet should consider the likely extension of component life resulting from the more effective greasing an automated system provides.

Erb Transport Limited in Baden, Ontario, Canada, was an early adopter of automated lubrication systems more than 10 years ago. "Lubecore is our primary provider on all of our power units, which includes long-haul sleeper tractors and regional tractors, as well as the Erb straight-truck fleet where liftgates are also protected by automated lubrication," said Jim Pinder, senior corporate fleet director for Erb Transport.

According to Pinder, an automated system has allowed the Erb maintenance team to better schedule PM1 inspection timeframes knowing all components connected to the system are regularly lubricated. Additionally, due to the improved lubrication of the fifth wheel, steer tire and trailer tire wear have been reduced. "Trailer pin plates are also lasting longer since fifth-wheel grease is transferred to the trailer during operation," Pinder explained. "Issues with seized brake components have also been eliminated, which extends brake lining life."

Of course, a technician doesn't have to worry about any of that if the vehicle has an automated lubrication system. However, the system has to work properly, and the fleet needs a plan for making sure it does.

"Because an automated system eliminates many of the machine's regular walk-arounds, a leak or faulty line could go undetected and lead to components not receiving the lubrication they need," Boren said. "When considering a switch to an automated system, be sure to include a plan for the operator to maintain daily inspections of the system and lines."

Good preventive maintenance is all about keeping an eye on the vehicle. Whether hand-greasing or relying on an automated system, it's important to keep those eyes wide open. The difference is in how the technician will be able to use their hands when that vehicle is in for service.

Carrier Transicold

APU innovations take heat off fleets

Auxiliary power units save on fuel and reduce engine wear, but do require some maintenance. Recent innovations have made that less of a hassle for fleets.

By John Hitch

Temperatures aren't the only things that soar in the summer. Fuel prices also rise as demand goes up. Both are good reasons for over-the-road fleets to equip their sleeper cabs with auxiliary power units (APUs).

These optional units power the truck while the engine is off, eliminating the need to idle to keep the cab's climate comfortable while the driver takes an hours of service break. The APU can either directly draw from the diesel tank or run off stored battery power. The benefits include lower fuel costs, less engine wear and tear, and reduced emissions.

The alternative, idling, is a costly proposition.

"At current prices of $4 per gallon, a 10-hour rest period comes out to $32," noted Sean O'Connor, division manager for Go Power Fleet. Go Power provides APUs and solar solutions to improve engine-off energy generation. "However, the cost of idling is more than just the cost of fuel. One hour of idling is estimated to cause roughly 175 miles of engine wear. The related maintenance costs quickly jump into the tens of thousands of dollars."

That's not all. OTR trucks in the shop for that extra maintenance keep their drivers from working. APUs take the heat off while allowing cool air and hotel power for other amenities to stream into the cab.

"Driver retention is such a hot topic, so that's another big reason why a lot of fleets are choosing to go with the APU as well," offered Kyle Westermann, Thermo King product service manager for TriPac, the company's APU solution.

There's a lot to like about APUs, but they also require some tender loving care.

"Just like any other mechanical system, that maintenance-saving APU itself needs some care and service to keep it performing reliably for the long haul," said Ryan Rubly, Carrier Transicold's product manager for alternative power.

Like diesel engines, diesel APUs have aftertreatment systems. Electric APUs don't, but lithium-ion batteries should be managed appropriately. Recent innovations from manufacturers have addressed these issues and more.

Diesel APU maintenance

The first thing to remember is that diesel APUs do have regular PMs just like any mechanical system.

"At a service interval of 1,000 hours, Carrier Transicold recommends checking coolant and oil levels, inspecting belts, hoses, and air filters among other visual assessments of its diesel APU system components," Rubly said. "At 2,000 hours, which might equate to a year's service in many instances, the engine oil and oil filter, air filter, and fuel filter should be changed along with the cabin air filter. Other system inspections are recommended, such as the air conditioning system and heater."

He also noted that because of where the APU is mounted (usually on the passenger side on the back of the tractor), grime, dirt, and salt can build up, so annual cleaning of the radiator and

» **The Thermo King 3rd-generation TriPac APU features a passive aftertreatment system and optional telematics, a first for the technology.**
Thermo King

condenser coils will prevent rust and early component failure.

"Just hit it with a garden hose to clean those fins out to ensure adequate airflow through the condenser coil," suggested Westermann.

The TriPac product manager also said to ensure the evaporator area has adequate airflow during inspections and is not blocked by tools, duffle bags, chains, or whatever else a driver may have packed near the APU.

What's new with diesel APUs?

One thing truckers hate is to pull over and wait for a forced regeneration cycle of the engine's aftertreatment system. A diesel APU's DPF also needs to burn off soot, which, for the TriPac Evolution, requires a driver to maintain highway speeds for 60 to 80 minutes, Westermann explained. If they can't, the driver would have to manually initiate a forced regen of the APU's system. If they don't do that within 10 to 15 hours, the APU would shut down.

With the new 3rd Generation TriPac—which goes into production this month—iterated to meet EPA Tier 4 compliance, Thermo King took the opportunity to completely redesign the aftertreatment system. (This is only available on the 50-state compliant model, not the 49-state compliant version.)

"The advantage of our new system is it requires no driver interaction—it's completely passive," Westermann said. "And the time of that regeneration is reduced, on average, down to eight minutes."

The 3rd-gen TriPac also uses 25% of the fuel per hour that idling would, which Thermo King said saves an average of 2,500 gallons of fuel per year. If diesel costs $3.50 a gallon, an APU-equipped truck would save $8,750 per year.

Both 3rd-gen models have the option to utilize TracKing telematics, which provides fleets with run hours, cabin temperatures, and fuel tax reporting, as well as maintenance alerts and software updates in real time.

Rubly said that if an APU has a fuel-fired heater, it should run for 30 minutes each month. Carrier's just-released Aspen APU improves upon this by "provid[ing] electric heating via its powerful generator, which eliminates the need for the monthly operational tests required of a fuel-fired heater, as well as the related fuel consumption," Rubly said.

The Aspen also runs self-diagnostic tests, which take a few minutes and report any problems via fault codes. The control interface also provides fault codes, operating temperature, and voltage data.

"Additionally, the unit keeps tabs on system run-hours, enabling automatic alerts as to when service is due," Rubly said.

To support the Aspen, Carrier developed CabinTech software, "which provides technicians with comprehensive system insights, including the ability to review diagnostic information, graph real-time run parameters, and configure APU system operating parameters and preferences via connection to a laptop," Rubly said.

Electric APU maintenance and innovations

Rubly noted that upfitting an electric APU with lithium-ion batteries reduces maintenance needs and improves driver satisfaction. They cost more upfront "but offer significantly longer battery operational time and lifespan," he added.

AGM batteries, on the other hand, cost less though they "require replacement after three to four years due to degradation of battery performance," Rubly noted. "If a driver is complaining of short run times with a battery-based APU, the battery is typically the culprit."

Carrier Transicold's ComfortPro electric APU also uses an isolator to ensure the truck start batteries don't degrade due to APU usage, which helps to extend battery life and mitigates potential dead battery callouts on the tractor itself.

According to Go Power, putting solar panels on the cab roof can triple the life of APU batteries.

"Because the solar power is keeping the batteries within the healthy range, they are not sulfating, which means they degrade at a much slower rate than usual," O'Connor said. "So, the benefits here would be less battery replacement and fewer service calls for jumping dead batteries."

He added that for diesel APUs, the solar system keeps the main battery at a higher state of charge, which allows the APU motor to run less.

The next question is what kind of maintenance the panels need.

"The panels can be walked on and are tested to withstand 2-inch hailstones fired at 51mph. These kits are rugged and can be expected to last a long time," O'Connor concluded.


Photo courtesy of Missy Albin

Don't distress; de-stress your diagnostic process

Troubleshooting a truck can be a stressful situation, but following a few simple diagnostic steps will lead to faster uptime and fewer headaches.

By Missy Albin
SR. LEAD MASTER TECHNICIAN, TAYLOR AND LLOYD
Missy Albin has been recognized by International Trucks as "one of the best technicians in the network" and is the OEM's Female Technician Ambassador for the Tech EmPowerment recruitment program. She began working on diesel trucks in 2004 and joined International in 2009 at an IC dealership. While pregnant in 2017, Albin continued to work in the shop and even earned her Master Truck Certification during that time.

Diagnosing commercial vehicle issues can be challenging and stressful, especially when you run into a laundry list of fault codes while plugging in an engine control module (ECM). Deciphering which codes are relevant can become overwhelming in the moment.

When I was first learning how to diagnose, I was taught the KISS (Keep It Simple, Stupid) method. That was tough to grasp in the beginning because diagnosing a sophisticated Class 8 truck is far from simple. During early attempts, my eyes would glaze over, my head would empty, and by the end of the day, my body would feel numb. There were times when I went in the wrong direction, and possibly in a circle a few times. Hours or days later, I would find the answer.

Now, because I learned how to look at problems differently and approach issues more logically, the answers come much easier. Instead of feeling exhausted and numb, I experience a sense of accomplishment after a successful diagnosis and repair.

Finding a good repair path will help you avoid the inevitable "diagnostic headache" you get when exhausting your options one by one. With the right vantage point and approach, any resourceful technician can solve even the most complex problems.

My method of troubleshooting a complex unit—one that contains many codes within multiple systems—is to first look at the big picture. Then put the pieces together, and use the process of elimination to find your root cause of failure. This includes reviewing the driver's concerns and the vehicle's repair history and code history. The most important piece is to review the active and inactive codes within the module to separate system concerns. The goal is to organize your systems and use the process of elimination to find your correct diagnostic and repair path.

It is important to treat active fault codes with a higher degree of priority. Inactive fault codes should be part of your diagnostics through your process of elimination, but inactive codes might not meet a threshold in that current moment, such as with key on/engine off tests or if a vehicle has an intermittent concern. Even at times when the engine is running, you may still need to meet thresholds before that system code comes forward.

Once you read all the code descriptions, it's now time to separate the descriptions by their systems. For example, you may get EGR, DPF, and SCR codes in one scan. I would then group the system codes separately.

I find it less overwhelming to look at each system group of codes individually. However, keep in mind that the different system groups may be related through symptoms within the systems and may not show through a code.

For example, if an air compressor intake hose ruptures and goes unnoticed for an extended period, resulting symptoms would eventually lead to EGR system concerns in the form of a plugged mixer duct and EGR cooler. Then the DPF and the diesel oxidation catalyst (DOC), which are downstream components, can be adversely affected. Low intake pressure can cause excessive black smoke, plugging exhaust filters and leading to excessive or incomplete regenerations.

You should note that each OEM does have a fault code ranker in development to help point you in the right direction. However, let's focus on how to find the best diagnostic path assuming that we lack a current OEM fault code ranker. When we have all our systems separated and our repair history, code history, and driver concerns reviewed, we are ready to find our diagnostic paths.

While this process is still very complex and technical, it can be simplified. The most logical way I form my diagnostic paths is by using failure mode identifiers (FMIs). Rather than

attempting to memorize hundreds of DTCs or SPNs (suspect parameter numbers), FMIs have 23 values. These describe how a circuit, component, and/or system has failed. When I do not have the manufacturer's FCAP or diagnostic tree to follow, I use FMIs. The FMIs are going to send you down the best diagnostic path in order to verify your repair process.

Under each system, start by grouping direct circuit failures together. These FMIs are 3, 4, 5, 6, 9, 19. This group is based on actual circuit failures and should be diagnosed first. Nevertheless, I have seen FMI 9 and FMI 19 derive from failed sensor modules as well, like NOx and QLS sensors.

You must understand basic electrical theory when diagnosing in this direction. The logic within the module will depend on how the circuit is looked at. You may get FMI 3 (an out-of-range high) with a two-wire sensor or FMI 4 (an out-of-range low) with a three-wire sensor, and possibly have the same cause, a broken wire.

Next, group and diagnose the components. This group puts you toward a monitored system component failure and/or components associated with that system of concern. Those FMIs are 2, 7, 8, 11, 12, 13, and 14.

On occasion, component FMIs need to be diagnosed first if you see a 2, 13, or 14. For example, a VGT actuator has an FMI 13, or "out of calibration." The cause is most likely the actuator and will possibly require calibration during a new install. Some FMIs, like 11,14, and 31, may be manufacturer-specific.

Lastly, the third group is System FMIs: 0, 1, 10, 15, 16, 17, 18, 20, 21, and 31. These describe the system's inefficiency and may provide the level of condition.

For example, if the unit is in derate and the DPF is plugged, or has SCR system-related failures, you'll get a red stop engine. You will see active FMI 0, 15, and/or 16 in the system for "Data Valid But Above Normal Operational Range—(15 for least, 16 for moderately, 0 for Most Severe Level)."

If your ECM displays FMI 0, the data your ECM is receiving is valid and now meeting the threshold of most severe level.

If you don't have the right strategy, discovering this could take much longer and lead to much higher stress levels. That's not good for you or your customer. But if you approach it with the right technique, diagnostics can truly be fun. Just remember to look at the bigger picture and narrow down the root cause using the process of elimination and a systematic method, and then make the necessary corrections.

Getting those trucks out of the bay as working right will provide you with that amazing feeling of success and allow you to move on to the next challenge.

SPECIAL SECTION

TMC

TURNING EXPERIENCE INTO PRACTICE

EXCELLENCE IN MAINTENANCE FOR QUALITY CONTROL

Technology & Maintenance Council

Turning Experience Into Practice

June 1, 2023

Dear Trucking Industry Professional:

ATA's Technology & Maintenance Council (TMC) invites you to join us for our 2023 Fall Meeting, Sept. 17-21, at the Huntington Convention Center in Cleveland, Ohio. Once again, TMC's Fall Meeting features a strong slate of educational sessions for equipment professionals, as well as a host of activity geared for truck technicians.

The theme of TMC's 2023 Fall Meeting — **Excellence in Maintenance for Quality Control** — centers around finding answers to the environmental, economic, cybersecurity and regulatory challenges that face our industry. Many of our educational sessions will address these topics, as explained in our fall meeting promotion.

In addition, TMC is holding North America's 18th annual **National Technician Skills Competitions** September 17-19. The event — **TMCSuperTech 2023** — will feature three separate competitions — our traditional (heavy-duty) track, trailer track, and light/medium vehicle track. The event showcases our industry's commercial vehicle technicians, who will compete for top honors and valuable prizes as they demonstrate their diagnostic abilities through a series of skills stations. Organized by TMC's Technician & Educator Committee (TEC), TMCSuperTech 2023 will this year start Sunday morning and conclude Monday evening. Awards will be given to the top three technicians and skills station winners during Tuesday evening's Awards Banquet. This year also features our eighth Student Technician Skills Competition, TMCFutureTech 2023. All meeting attendees are welcome to observe the competitions.

The Council is also offering the **TEC Technician Training Fair.** The Fair will take place on Tuesday, Sept. 19. These sessions are being organized by TMC's TEC, and will feature expanded blocks of training on root cause diagnostics, and diagnostics and repair of diesel aftertreatment & advanced driver assistance systems (ADAS). For details, please review the material provided in the enclosed meeting brochure, also found on TMC's event website: http://tmcfall.trucking.org. For information, call (703) 838-1763.

On behalf of TMC's Board of Directors, I encourage you to take advantage of this opportunity and join us at TMC's 2023 Fall Meeting. We look forward to seeing you in Cleveland!

Sincerely,

Robert M. Braswell

Robert Braswell
TMC Executive Director

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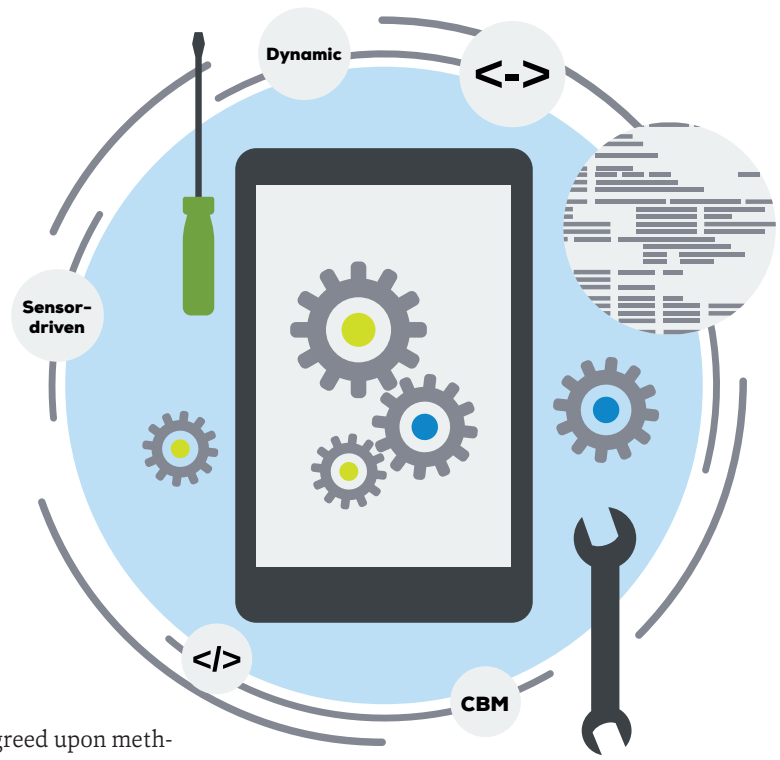
(703) 838-1763 • E-Mail: tmc@trucking.org
http://tmc.trucking.org

TMC cover photo: John Hitch | Fleet Maintenance

VMRS adapts to standardize predictive and prognostic maintenance alerts

BUILDING ON CODES FOR CRASH AVOIDANCE AND LANE DEPARTURE, TMC FOCUSES ON A NEW CLASS OF CODING TO COMMUNICATE ANTICIPATED SERVICES.



54372526 | Vadim Ermak | Dreamstime

By Jack Poster

From its inception, the Vehicle Maintenance Reporting Standards (VMRS) have been a collaborative effort involving a diverse group of contributors representing the equipment maintenance industry. Original equipment manufacturers (OEMs), parts manufacturers, fleets, service providers, and fleet maintenance software firms have all played a part in helping to expand the scope and acceptance of VMRS. It's been a team effort for more than 50 years and continues to be going strong year after year.

In recent years, ATAs' Technology & Maintenance Council (TMC)—the custodian of VMRS—have added codes for crash avoidance, lane departure, camera monitoring systems, adaptive speed control, and most recently, electric vehicles, all with the help of folks from the VMRS-user community. VMRS continues to reflect new technologies that are developed for equipment and equipment maintenance and will continue to do so for many years.

The torrent of activity surrounding telematics services has prompted TMC to begin considering a new class of VMRS coding to address predictive and prognostic maintenance alerts. These codes will standardize the electronic maintenance alerts back office systems communicate to vehicles when services are anticipated.

Brian Mulshine, director of digital service delivery at Navistar, started the conversation during the VMRS Codes Task Force meeting at the 2022 TMC Fall Meeting. The idea is to create a common language/schema in VMRS to be leveraged by vehicle OEMs, engine manufacturers, and component suppliers to digitally communicate "predictive/prognostic maintenance alerts/requirements."

VMRS coding has traditionally been used to record maintenance/repair data after the service event takes place. Parts and labor are usually entered by the attending technician or manager, using some type of maintenance software or filling out a work order by hand.

However, with the advent of artificial intelligence (AI) and machine learning, things in the maintenance world are changing. Vehicles, equipment, and/or components now send diagnostic information directly to the maintenance department. There needs to be an agreed upon method of interpreting and implementing the received data, and many believe VMRS is the perfect method. It's been the "universal" maintenance language for more than 50 years and continues to prove to be flexible and adaptable.

VMRS Code Keys are data elements or data "buckets" that hold individual codes of just about anything pertaining to maintenance, repair, and vehicle specification. Think of a Code Key as an individual book in the VMRS library. There's a book for repair reasons, work accomplished, part position, part identification, etc. Most industry professionals are familiar with the VMRS nine-digit Component Code Key 33, but VMRS comprises 65 separate Code Keys, each containing codes related to various areas of equipment maintenance and equipment designation. There are Code Keys that contain codes for designating labor, part failures, equipment attributes, and much more.

As technology evolves for improving maintenance of vehicles, most OEMs are working on "data driven" maintenance to improve the customer's experience. New forms of maintenance include condition-based maintenance (CBM), sensor-driven and dynamic (advanced) PMs, and methods of leveraging real-time fuel economy to adjust intervals.

Mulshine has brought in many interested parties from various areas of equipment maintenance to help develop this new standard — OEMs, fleet software providers, engine manufacturers, and fleets have all expressed an interest in adding the new Code Key to VMRS. They all agree on the need for a common language for indicating the required needed service. The codes can be used across all vehicle/engine OEMs and component suppliers to digitally communicate predictive and prognostic maintenance and repair requirements.

Multiple vehicle and engine manufacturers have data currently or becoming available soon that designates remaining useful life (RUL) of certain components and/or maintenance due soon. Because no standard is currently available, fleets are receiving this information by email with attachments. Customers are then expected to take the data and enter it in their systems.

The proposed VMRS Code Key will include new codes with this information, offering fleets a way to communicate and receive this important data.

The new VMRS Code Key is expected to include service requirements that are due soon, past due, and need replacement soon. Some examples are:

- **Past due** – Oil change, fuel filter, lube driveline.
- **Due soon** – Valve lash adjustment, DEF filter.
- **Needs replacement soon** – Air dryer, fan belt.

Mulshine has put together a list of service requirements from several OEMs that will be the basis for the code descriptions in the new Code Key and, like the existing VMRS Code Keys, there is always room for expansion.

Another proposal is to expand existing VMRS Code Key 52: Part Status Codes to include required elements for predictive and repair dispositions. The code key would be renamed "Maintenance and Part Status" reflecting the new proposed VMRS Code Key. Examples include "due soon," "past due," "service immediately," and "request performed."

New VMRS Code Key proposals are subject to the same balloting and appeal development process as any other TMC Recommended Practice. They must be first developed and approved by the VMRS Codes Task Force, then reviewed by the appropriate Study Group Chairman and TMC staff, then put up for balloting to the entire TMC membership. If balloting is successful, and there are no appeals following the balloting approval, the Code Key will become part of the VMRS library, collectively entitled TMC RP 802, TMC/ATA Vehicle Maintenance Reporting Standards (VMRS).

The Task Force is working on the proposed additions this summer and expects to send the new material for balloting following TMC's 2023 Fall Meeting in Cleveland, Sept. 17-21.

VMRS has always reflected the latest in technology when it comes to maintaining many types of equipment, it's been the industry standard for more than 50 years and will continue its mission into the future. The industry is undergoing rapid change and VMRS promises to keep current and relevant to its many users no matter what the future brings.

National Technician Skills Competitions | LIST OF SKILLS STATIONS (subject to change)

SUNDAY

HEAVY-DUTY DAY 1 TRACK

HD1	ASE Written Test
HD2	RP Manual
HD3	Wiring Diagrams
HD4	Lubricants & Fuels
HD5	Coolants & DEF
HD6	Electronic Engine Diagnostics
HD7	Electrical Circuits
HD8	Fasteners
HD9	Sealants and Adhesives
HD10	Service Information
HD11	Cybersecurity
HD12	Trailer Lighting

MONDAY

HEAVY-DUTY DAY 2 TRACK

HD14	CNG Fuel System Essentials
HD15	Brakes
HD16	Wheel End
HD17	Fifth Wheel
HD18	Liftgates
HD19	Automated Manual Transmission
HD20	Tire & Wheel
HD21	Tractor PMI
HD22	Starting & Charging
HD23	Steering & Suspension
HD24	Aftertreatment Mechanical

TRAILER TRACK

T1	ASE
T2	Hydraulics & Drivebelts
T3	Trailer Wheel End
T4	Sealants and Adhesives
T5	Trailer Fasteners
T6	Trailer PMI
T7	Trailer Alignment
T8	Roll-Up Doors
T9	Trailer Lighting
T10	LMV/Trailer Liftgates
T11	Central Tire Inflation
T12	Trailer Electrical Corrosion
T13	Trailer ABS

LIGHT/MEDIUM TRUCK TRACK

LM1	ASE
LM2	Fasteners
LM3	Wiring Diagrams
LM4	RP Manuals
LM5	Coolants & DEF
LM6	Sealants and Adhesives
LM7	Electrical Circuits
LM8	Lubricants & Fuels
LM9	Trailer Wheel End
LM10	EVAP Systems
LM11	LMV Preventive Maintenance
LM12	LMV/Trailer Liftgates
LM13	CNG Fuel Systems Essentials

FUTURETECH 2023 TRACK

FT1	ASE
FT2	Fasteners
FT3	RP Manuals
FT4	Wiring Diagrams
FT5	PMI
FT6	Electrical Circuits
FT7	Lubricants & Fuels
FT8	Cybersecurity
FT9	Coolants & DEF
FT10	Sealants and Adhesives
FT11	Trailer Wheel End
FT12	CNG Fuel System Essentials
FT13	Hydraulics & Drivebelts

Council members seek consensus on next generation tractor-trailer interface

THE GROWING DATA DEMANDS OF ADVANCING TECHNOLOGY DRIVE NEW COMMUNICATION SOLUTIONS.

By Robert Braswell

It's served the trucking industry well, but most industry experts agree the time has come for the venerable SAE J560 seven-pin tractor-trailer connector to be replaced with a new solution that will better accommodate the growing power and data needs of 21st century trucking. The tough question is, what's next?

While this robust, tried-and-true 12-volt connector is utilized ubiquitously throughout the North American market, the power and data demands of each generation of technology advancement have pushed the limits of what can be done with this connection. Multi-voltage requirements, solar installations, electric drive and regenerative braking axles, advanced driver assistance systems (ADAS) and automated driving systems' (ADS) — and the host of sensors, emitters, and cameras that support them — mean the need for a new connector standard is increasingly necessary and urgent.

ATA's Technology & Maintenance Council (TMC) recently released a position paper from its S.7 Trailers, Bodies & Material Handling Study Group regarding the tractor-trailer electrical architecture of the future. The paper — TMC PP 2023-1: Design Recommendations for Next Generation Trailer Electrical Architecture — has several recommendations for smart trailers and hopes that trailer manufacturers will use these as a road map for the development of technology that will access the robustness of suppliers' offerings. TMC specifically wants to ensure that new interface solution will be backward compatible as well.

S.7's Next Generation Trailer Electrical Architecture Task Force identified several principles that guided their research. First, that the current electrical architecture is inadequate for the future. Second, that trailer tracking is well established in the industry and is only growing. Third, that electric-powered refrigeration may require off-board charging of trailers. Fourth, that new and safer vehicles pursued by original equipment manufacturers (OEMs) require additional information and control. Fifth, that many companies have proposed new architecture for trailers. Sixth, TMC established similar issues regarding tractor data networks in the 1980s. Seventh, fleet input is critical for more efficient and reliable electrical information on trailers. Finally, that collaboration is anticipated with other TMC Study Groups.

» **TMC Connector Task Force members are asked to evaluate how well each prototype would provide the desired technical performance criteria.**
TMC

Based on these principles, the Task Force is working with TMCs S.1 Electrical Study Group and its Next Generation Tractor-Trailer Interface Task Force to obtain input from tractor manufacturers on future needs for safer vehicles; obtain input from fleet/equipment users on the future of electrical wiring; review proposals from manufacturers; and develop initial expectations for a recommended practice from TMC.

TMC has its own thoughts on how the industry could improve the safety, efficiency, and reliability of freight. Smart trailer expectations include the right for users to repair their own equipment; the preference of patent-free solutions from industry groups; the preference of global non-proprietary solutions; the consideration of forward/backward compatibility; the importance of safety; the need to standardize on a single telematics device when untethered; better support for doubles and triples; the need for upgradable software; the fair sharing of data ownership and electronic documentation; the necessity of high-speed connections for smart trailers; the focus on cybersecurity due to increasing connectivity of devices; the consideration of future power connections; and the consideration of installation, maintenance, and inspection in factories and in the aftermarket.

During TMC's 2023 Annual Meeting in Orlando earlier this year, the S.1 Task Force presented eight competing designs for what the future tractor-trailer interface could be. The intention of the construction of the recommendations was to describe an "ideal" interface and to not be constrained by existing art.

However, significant consideration was given both to available and yet-to-be available technology, and the interface is expected to be backwards compatible, yet expandable.

The more than 50 technical criteria identified by S.1 falls into the following categories:

1. Compatibility;
2. CAN networks and related ABS/EBS databus recommendations;
3. Ethernet network recommendations;
4. Recommendations for additional pins and pin assignments;
5. Intellectual property discussions and recommendations.

Council fleet members continued to study these design proposals during a series of webinars in April and May and soon will provide feedback through a detailed survey that TMC staff will administer.

Following this, task force members will be asked to evaluate how well each prototype would provide for the trailer support needs of the "guiding principles" as well as the desired technical performance criteria. The Task Force's findings will then be presented at TMC's 2023 Fall Meeting in Cleveland, Ohio in September. Soon after, TMC would then likely begin the process of developing a Recommended Engineering Practice to finalize the criteria for a new standard design.

Electronics are going to become increasingly prevalent on smart trailers and OEMs and others need to take note. The recommendations from TMC's S.1 and S.7 Task Forces and other organizations will ensure that effective future standards are set as trucks and trailers become more autonomous, self-diagnosing, and integrated with other devices. The sheer volume of multi-megabyte cybersecure dataflows and the bi-directional power flows between tractors, trailers, and dollies will require multi-voltage systems for future 24- and 48-volt, with even high voltages where electric supplemental drive axles and regenerative braking on trailers may come into play. Trailers are ever more a global commodity, and the one potential of the TMC effort may well be to identify a worldwide solution that still is able to meet the unique needs of the North American market.

TMC recognizes that the challenges facing future combination-vehicle connectivity are not easy. With millions of trailers in use with as much as 20 years of expected service life in many duty cycles, protecting the investments in these legacy assets is paramount, and the reality of fleet operations will require a "mixing and matching" of multiple generations of units and technologies on an ongoing basis. While adoption of a new tractor/trailer connection will be organic and market driven, TMC is engaged in this process to provide transparency and objectivity so that the transition can be rational, driven by practicality, and ultimately best meet the needs of fleets.

TMC Special Section
LEARNING OPPORTUNITIES

Educational sessions

→TECHNICAL SESSIONS

Check It After You Spec' It!
Technical Session #1
Wednesday, Sept.20:8–9:30a.m.
Truck equipment and technology continues to become more complex with every model change and fleet managers are faced with decisions on new systems and components that must work together to meet business needs. As a result, many stakeholders involved in the truck purchasing process find it critical to build one truck to a particular specification, perform a pilot review of the new equipment to verify it is built exactly as ordered, and confirm the build quality of the equipment. Conducting a pilot review and correcting issues at the factory or upfitter prior to delivery to the fleet will help reduce delays and repair costs in putting equipment into service after it is delivered to the fleet. But what about after the pilot review is complete and you start taking deliveries of your newly specified vehicles? Are you satisfied with the quality and build accuracy of the vehicles for which you are supposed to place into service? Particularly since the COVID pandemic, many fleets have struggled with in-service issues due to parts and labor shortages at the original equipment manufacturer (OEM) level, not to mention the same struggles with their own maintenance and repair operations. Some fleets have reported to ATA's Technology & Maintenance Council (TMC) that they have had greater difficulties accepting units from the factory because they do not meet the specifications intended. Attend this session and learn how to ensure your new vehicles meet your expectations before you place them into service. We'll cover recommended practices for pilot reviews, postpilot review, and pre-in-service inspections to catch problems in the inspection bay before they arise on the road.

Quality Maintenance Through a Quality Culture
Technical Session #2
Thursday, Sept. 21: 7:45–9:15 a.m.
A maintenance operation needs a formal, structured, and repeatable framework to establish a quality assurance program within a given facility that is dedicated to ensuring all serviced vehicles are ready for operation after a maintenance/repair event. Poor repair quality and repair "comebacks" cost both vehicle owners and repairing facilities time and money. Processes should be in place that reduce or eliminate issues created by human factors. TMC recommended practices identify eight critical components to a sound quality control program, which include visual assurance, process, metrics tracking, inspection, business considerations, checklists for quality and repair, and calculating rework costs. During this session, panelists will provide recommended practices for and examples of implementing, sustaining, and measuring a successful quality control program that mitigates repair issues created by, but not limited to, workmanship, forgetfulness, oversight, and carelessness. We'll share proven strategies for delivering quality maintenance through the healthy cultivation of a quality culture in fleet and service provider operations.

→STUDY GROUP SESSIONS

Novel Approaches to Tire Inflation and Monitoring Management
S.2 Tire & Wheel Study Group
Thursday, Sept. 21: 9:30–11 a.m.
Commercial truck tires are designed to run under a wide range of real-world conditions and tire pressure changes are a natural result. With tire temperature, ambient road temperature, vehicle loads, vehicle speeds, and road surface all impacting tire pressure, tire inflation monitoring and management can be challenging, as fleet managers will attest. Maintaining a minimum cold tire pressure is critical, with load/inflation tables determining the minimum air pressure needed to support the tire load. Maintaining proper tire inflation will maximize tire life and casing durability as well. It also reduces overall tire costs, downtime, tire replacement, irregular wear, wheel replacement, road debris, and the natural resources required to manufacture tires and retreads. Correct inflation will also increase benefits such as fuel efficiency, safety, driver retention, and uptime, all of which have a direct impact on cost per mile. Today's fleet managers have it easier than previous generations, since there are a number of tire inflation and/or monitoring systems available that help ensure sufficient inflation for the load being carried. But while tire labor can be reduced, it is still necessary to periodically inspect tires to ensure they are serviceable, properly inflated, and the systems are working correctly. During this session, TMC's S.2 Tire & Wheel Study Group will examine what's new today in the area of tire inflation and monitoring management. Panelists will feature experts in tractor and trailer tire construction and inflation, as well as tire pressure monitoring systems (TMPS).

We'll also have fleet representatives on hand to discuss the lessons learned in creating a successful tire inflation management program.

Quality of Energy Sources and How They Affect Wells-to-Wheels Emissions in a Fleet Operation

S.3 Engine/S.11 Sustainability & Environmental Technologies Study Groups
Wednesday, Sept.20: 1:15–2:45 p.m.

The drive to decarbonize the trucking industry is rapidly revolutionizing the way freight moves in North America. According to the Congressional Budget Office (CBO), emissions of carbon dioxide in the transportation sector accounted for 38 percent of energy-related emissions in the United States in 2021. Focus on decarbonization is accelerating, especially in heavy-duty, longhaul trucking. While many fleets have set aggressive greenhouse gas (GHG) emission reduction goals, many of the options to achieve those goals require significant investment in both new technologies and infrastructure, including some that are outside of fleet operators' control, making implementation many years away. Moreover, the source of electric power makes a big difference in its impact. Options that require limited-to-no significant infrastructure changes that can achieve significant carbon intensity reduction using internal combustion engine (ICE) powered vehicles include biodiesel, renewable diesel, natural gas, renewable natural gas, and hydrogen. Attend this session and learn how the various options compare when it comes to real-world attainment of decarbonization. We'll explore their impact on emissions based on a total wells-to-wheels comparison, explain the details of these options, offer practical considerations to implement them in your fleet, and describe their impact on your operation's GHG reduction goals.

Quality Through Vehicle Maintenance Reporting Standards (VMRS): Best Practices and Next Steps

S.5 Fleet Maintenance Management Study Group
Wednesday, Sept.20: 1:15–2:45 p.m.

Since 1970, the purpose of the Vehicle Maintenance Reporting Standards (VMRS) has been to provide a vital communication link between maintenance personnel, computers, and management. It establishes a "universal" language for fleets, original equipment manufacturers' (OEMs), industry suppliers, computers, and those whose responsibility it is to specify, purchase, operate, and maintain equipment. Developed by and for equipment users under the auspices of the American Trucking Associations and curated by its Technology & Maintenance Council (TMC), VMRS provides the discipline necessary for different industry segments to communicate with each other. VMRS is the shorthand

of maintenance reporting, eliminating the need for extensive written communications. VMRS affords users the ability to create their own maintenance identification number or "MIN." This allows fleet managers to have greater awareness of their operation's historical maintenance, repair, and labor data to best optimize and monitor their current and projected performance. Attend this session and receive a comprehensive view of the current and future state of VMRS and its many applications. We will cover VMRS's utility in warranty administration, maintenance and repair reporting, and new adaptions for improved predictive and prognostic maintenance/telematic services and integrated vehicle health management. We'll also introduce new VMRS offerings such as the Council's online VMRS services portal. Experts will share how telematics, diagnostics, and VMRS will change the way we approach our fleet's information and how we process it.

Aerodynamics: What Works For You?

S.7 Trailers, Bodies & Material Handling Study Group
Wednesday, Sept. 20: 9:45–11:15 a.m.

Aerodynamics are unquestionably important to achieving fuel economy gains. Based on U.S. Department of Energy (DOE) research, aerodynamics effect fuel efficiency at 35 mph. At 65 mph, about 53% of the horsepower generated by a combination vehicle is used just to move the unit through the air, let alone battling crosswinds. Industry studies have shown — with SAE International reconfirming in 2012 — that the average wind speed a truck experiences while driving in the United States is approximately seven MPH, with wind speed risk varying by geographic region. Also, one cannot visualize the airflow and associated turbulences around a moving vehicle. Therefore, ascertaining how well a device works is not a simple task, as results for individual aerodynamic devices cannot be simply added together to obtain a realistic result, either. Combinations of devices have to be tested together to properly evaluate the combination's overall benefit, which further complicates the task at hand. During this session, fleets and suppliers will examine new aerodynamic trailer offerings and design innovations. We'll look at the options available today, including rear, under-trailer, and mud flap. We'll also discuss several TMC recommended practices that can help fleets in spec'ing aerodynamic solutions and examine current research. Attend this session and learn what aerodynamic advances might work better for your operation.

Examining the Future of Data Access for Commercial Vehicle Operations

S.12 Onboard Vehicle Electronics Study Group
Wednesday, Sept. 20: 9:45–11:15 a.m.

TMC RP 1226B, Vehicle Accessory Connector Guidelines, offers industry guidelines for a standardized, non-original equipment manufacturer (OEM) specific vehicle accessory connector to interface aftermarket vendor electronics with a vehicle. The vehicle accessory connector is meant to make it easier for a secondary OEM upfitter or aftermarket vendor to connect a device to the vehicle while also ensuring the integrity of the vehicle's electrical or network/communication systems and following appropriate industry specifications. The vehicle accessory connector does not replace any onboard diagnostic (OBD) connector functions. It allows aftermarket devices to be installed in the vehicle without affecting the vehicle's databus. RP 1226B specifies the connector type and the signals available on the connector but it does not specify databus messages or messaging standardization. That's where a new effort by TMC's S.12 Onboard Vehicle Electronics Study Group comes in. S.12's RP 1226 Messaging Standardization Task Force is developing a recommended practice that defines messages and standards for RP 1226, which covers telematics and on-board diagnostic accessory connectors. The Task Force intends to develop an application program interface (API) so that fleets, telematics service providers (TSPs), and electronic logging device (ELD) providers will not have to go back to splicing into databuses to access data needed for maintenance, repair, and diagnostic processes. The RP 1226 defined connector is not just a diagnostic connector but is rapidly becoming the future gateway for onboard-to-offboard vehicle data communications. Future developments will require some standardization of data messaging to enable fleets to control their data streams from various technologies — such as smart trailers and automated driving systems — to meet their operational needs. Data streams will need to be interchangeable and cyber-secure across OEMs, TSPs, and supply chains and allow for seamless acquisition, turnover, and disposal of fleet assets. Learn why this effort is so important to fleets when it comes to ensuring equipment owner rights to maintaining their own vehicles and accessing/using their own data to best suit their own operational needs.

TMC Task Forces to Meet Tuesday, Sept. 19, 2023 in Cleveland, Ohio

The following Task Forces of the Technology & Maintenance Council (TMC) will meet in open session on Tuesday, September 19, 2023 at the Huntington Convention Center of Cleveland in Cleveland, Ohio. Task Force meetings are scheduled for approximately one hour and will take place between 8 a.m. and 4 p.m. eastern. Parties wishing information on how to attend specific Task Forces should contact TMC headquarters at (703) 838-1763 or visit http://tmcfall.trucking.org.

S.1 Electrical
- Future Electrical/Electronic Systems (Joint Future Truck/S.1)
- Electrical Diagnostics Incorporating Lab Scopes
- Microgrids and Battery Storage (Joint S.1/S.11)
- Next Generation Tractor-Trailer Interface
- Rear-facing LED Out-of-Service Criteria
- Wireless Charging Standards & Recommendations
- Chassis to Body Electrical Interface Guidelines for Construction Trucks (Joint S.1/S.14)
- Advanced Battery Technology
- RP Updates(S.1)

S.2 Tire & Wheel
- RP Updates (S.2)
- Considerations for Tires on Comm. Electric Vehicles
- Tire Maintenance Considerations for Light Comm. Vehicles (Joint S.2/S.14)
- Tire Conditions Analysis Guide for Light Commercial Vehicles (Joint S.2/S.14)
- Tire Maintenance Management
- Use of Telematics for ATIS and TPMS

S.3 Engine
- RP 318C Update (Engine OilAnalysis)
- RP 348A Update (Coolant Hose Rating Factors)
- RP 363A Update (Underhood Thermal Event Prevention)
- RP 322B Update (Coolant Pump Failure Modes)
- RP 309B Update (Preferred Fuel Spec No. 2-D)
- Leak Detection Guidelines for Electric Vehicles
- Coolants for Electric Vehicles
- RP Updates (S.3)
- Lubrication for Electric Vehicles

S.4 Cab & Controls
- RP Updates (S.4)
- Odometer Synchronization
- RP 430 Update (Guidelines for Collision Warning)
- RP 404B Update (Truck & Truck Tractor-Access Systems)
- In-cab Gas Detectors
- Conversion of Rear View Mirrors to Cameras
- RP 420B Update (HVAC Service Life Requirements)

S.5 Fleet Maintenance Management
- RP Updates (S.5)
- VMRS Codes
- VMRS Coding for Predictive and Prognostic Maintenance
- Health-Ready Components Standards
- Cybersecurity Issues
- Proper Vehicle Lifting Procedures and Equipment (Joint S.5/S.16)
- Electric Vehicle Pre-Trip Inspection Electric Vehicle Shop Bay Planning (Joint S.5/S.16)
- Parts Room Design Standardization
- Root Cause Analysis
- Cost Benefit Analysis of Extended Warranty

S.6 Chassis & Brake Systems
- RP Updates (Brake-Related RPs)
- RP Updates (Chassis-Related RPs)
- Towing Electric Vehicles
- RP 628C Update (Aftermarket Brake Lining Selection)

S.7 Trailers, Bodies & Material Handling
- RP Updates (S.7)
- Brake-Activated Pulsating Lamps
- RP 755A Update (Alternative Liftgate/Material Handling Charging Methods)
- Exploring Trailer Voltage Drop for Current & Future Demands

S.11 Sustainability & Environmental Technology
- RP Updates (S.11)
- RP 1109B Update (Type IV Fuel Economy Test Procedures)
- Energy Efficiency Test Procedures for Electric Vehicles
- Fleet Expectations and Guidelines for Spec'ing Electric Vehicles
- Understanding Electric Vehicle Efficiency Performance
- Electric Terminal Tractor Implementation Guidelines
- TCO Calculator for Electric Vehicles
- SmartWay Activities
- Energy Conservation/Industry Sustainability Update
- Charge Cycle Optimization and Energy Management for Battery Electric Vehicles
- Recommendations for Developing Charging Station Infrastructure for Commercial Fleet Operations

S.12 On-Board Vehicle Electronics
- CAN Bus Troubleshooting
- RP Updates (S.12)
- Open Telematics API
- RP 1226 Messaging Standardization
- Open Wireless Vehicle Diagnostic Adapter API

S.14 Last Mile & Vocational Vehicles
- Lumen Ratings Definition for White LED Worklamps
- VMRS Code Development for Specialty Vehicles
- RP Updates (S.14)
- Chassis to Body Electrical Interface Guidelines for Construction Trucks (Joint S.1/S.14)
- Class 2-6 Electric Vehicle Inspection Standards

S.16 Service Provider
- Safety Aspects of Electric Vehicles
- Digital Data Exchange and Management
- Service Provider Standards of Excellence
- When to Trade or Keep a Tractor (Joint S.16/S.5)
- Electric Vehicle Shop Bay Planning (Joint S.5/S.16)
- Implementing TMC RPs in Fleet & Service Provider Operations
- RP Updates (S.16)

S.17 Collision and Corrosion Control
- Cab & Control Corrosion Control
- Heavy-Duty Collision Repair Roadmap
- Frame Correction
- Corrosion Manual Update

S.18 Automated Vehicles
- Platooning
- Automated Driving System Selection Process
- Automated Truck Inspection and Enforcement
- Technician & Maintenance Shop Requirements for Automated Vehicles
- Trailer Specification for Automated Power Vehicles
- Automated Vehicle Industry Updates
- ADAS Selection and Specification

Technician & Educator Committee
- Future Technician Scholarships
- Fostering State Competitions
- Electrified Vehicle Safety Training for Technicians

Future Truck Committee
- Future Electrical/Electronic Systems (Joint S.1/FT)
- Future Tire Reliability/Durability
- Future Cab and Driver Interface
- Future Trailer Productivity
- Future Integrated Vehicle Health Mgmt.
- Future Chassis and Brake Systems
- Augmented and Virtual Training

Recommended Practices Enter Appeal Period

The Technology & Maintenance Council (TMC) of American Trucking Associations is proposing adoption of the following Recommended Practices:

- Proposed RP 189(T), Guidelines for Fifth Wheel Ground Strap Testing, Inspection and Maintenance— This Recommended Practice (RP) provides a system approach to properly test ground straps on a fifth wheel and heavy-duty truck, tractor, or dolly frame. This approach is designed to ensure proper installation and functionality.
- Proposed RP 238C(T), Troubleshooting Disc Wheel Looseness—This RP provides fleets with a logical approach to troubleshooting loose stud-piloted and hub-piloted disc wheels used on medium- and heavy-duty (Class 6-8) commercial vehicles.
- Proposed RP 241C(T), Tubeless Disc Wheel Inspection for Undersized Bead Seats—This RP provides information about the damage that results in undersized bead seats on steel and aluminum disc wheels (including dual and wide-base), which may result in a rapid loss of inflation and separation of the tire from the wheel.
- Proposed RP 249B(T), Safety Issues Related to the Use of Flammable Fluids During Tire Demounting—This RP advises those servicing truck tires of the risks associated with using flammable fluids to demount tires.
- Proposed RP 250B(T), Effects Of Extreme Temperatures on Hub-Piloted Wheel Torque and Clamp Load—This RP provides fleet managers and tire technicians information about the effects of extreme ambient and wheel end temperature changes on wheel nut torque and clamping force. This RP applies to hub-piloted disc wheels in applications using M22 or M22x1.5 phosphate/ oil-coated studs and organic coated nuts.
- Proposed RP263A(T), Use of Scalloped/Star-Shaped Hubs For Disc Wheels—This RP provides original equipment manufacturers (OEMs) and fleets guidelines when spec'ing disc brakes and inboard mounted drum brakes with hubs designed and manufactured with non-continuous, non-circular (e.g., scalloped, star-shaped, dented, or other) outer back-up diameter. This RP applies to steel and aluminum disc wheels only (not demountable rims) ,including single/ dual-mounted and wide-base wheels, and hub/drum components used on medium- and heavy-duty commercial trucks and trailers.
- Proposed RP319C(T), General Guidelines and Precautions on Supplemental Coolant Additives—This RP offers guidelines for the use of supplemental coolant additives (SCAs) used to protect heavy-duty vehicles filled with conventional inorganic acid technology (IAT) coolant. This RP applies to most formulations of conventional SCAs on the market intended for use in heavy-duty vehicle cooling systems.
- Proposed RP 360A(T), Diesel Exhaust Fluid Guidelines—This RP educates equipment users on selective catalytic reduction (SCR) technology and its use of diesel exhaust fluid (DEF). This RP will provide definitions and terminology of SCR systems, and offer guidelines on DEF storage and handling.
- Proposed RP 378(T), CNG Post-Collision and Thermal Events Mitigation—This RP offers recommendations for an incident action plan and what to do for a CNG vehicle post incident to make it safe. This RP will also discuss some of the characteristics the fleet or operator needs to be aware of when developing this procedure to ensure the system is safe at each stage of an incident.
- Proposed RP426B(T)v2, Service Guidelines for Primary and Supplemental Occupant Restraints—This RP covers all current and prospective occupant and supplemental restraints for use on all highway and on/off highway trucks and tractors.
- Proposed RP727A(T), Liftgate Specifications and Installation—This RP is designed to assist equipment users in specifying rear- or side-mounted, hydraulic liftgates
- Proposed RP744A(T), Pintle Hook Maintenance Guidelines—This RP offers guidelines for maintenance and inspection of pintle hooks used in heavy-duty applications.
- Proposed RP 750A(T), Upper Coupler Inspection Guidelines—This RP provides general guidelines for the inspection of the upper coupler structure of commercial van and flatbed semi-trailers equipped with a two-inch kingpin in a fixed-position coupler.
- Proposed RP 1438(T), Cost Analysis Calculator for Electric Power Take-Offs (ePTOs)—This RP provides a methodology for evaluating electrical- and/or hybrid driven power take off (ePTO) systems on Class 4-8 vocational vehicles by means of a spreadsheet format calculator. The purpose of this calculator is to assist fleet managers in assessing and justifying an ePTO solution for powering upfitted equipment.
- Proposed RP 1618(T), Vehicle Lifting Procedures and Equipment Guidelines—This RP offers guidelines on the operation, use and maintenance of full-rise lifting equipment that is used in maintenance operations on a daily basis. It also presents general safety, productivity, and ergonomic considerations by comparing working methods performed with and without different types of lifting equipment.

Any party may submit a written request of appeal of a proposed Recommended Practice (RP). However, the request must be received by the Technology & Maintenance Council within 90 days of publication of this notice. If no appeals are made at the end of the 90 days, the RP will be formally adopted by TMC. (The suffix "T" indicates an RP is proposed.)

With the printing of this issue, the following RPs are now open to the 90-day appeal process. Written appeals can be sent to TMC Technical Director Jack Legler, 80 M Street, SE, Suite 800, Washington, DC 20003. Phone: (703) 838-7956; jlegler@trucking.org.

FLEET PARTS & COMPONENTS

What's new in products for more efficient fleet operation.

Connects with Apple or Android devices via Bluetooth

The **Odyssey Connect** battery monitoring system from **EnerSys** is an active tracking platform that is compatible with both Apple or Android smart devices, delivering a range of battery health and performance data via Bluetooth. The Odyssey Connect system tracks both a battery's state of charge (SOC) and state of health (SOH), allowing users to receive warning and safety notifications on their smart device. Both the SOC and SOH data can be viewed over a period of six days, to better identify trends and anomalies. The program can also track battery voltage and temperature, the combined data for which can be viewed in a singular graph.

For more information visit **FleetMaintenance.com/53061208**

Provides 360-degree views

The **AI Omnicam** from **Motive** provides 360 degrees of views around a vehicle and, when paired with Motive's AI Dashcam, can also provide visuals into the interior of the vehicle as well. The expanded view encompasses a vehicle's side, rear, passenger, cargo monitoring, and surrounding area, providing both high-definition video and automated alerts for drivers regarding side and rear collisions. Powered by AI, all of these features may assist fleets with driver training and safety, giving businesses a better understanding of road and job-site incidents.

For more information visit **FleetMaintenance.com/53063492**

Features several charging interfaces

The **ABB HVC360 power cabinet** is a fleet charging solution that can charge up to four trucks at the same time. Configurations can be back-to-back, side-to-side, or along a wall, and can be set as much as 328 ft. from the power cabinet while allocating different levels of power to each dispenser based on the vehicles charging. The charging interfaces available include the HVC Depot Box Single Outlet with up to 250A CE/200A UL, the HVC Depot Box Dual Outlet with up to 250 A CE/200A UL, the HVC Panto-up Depot Set with up to 350A Contact dome, the HVC Panto-down Depot set with up to 400A Depot pantograph, the HVC Cable Reel Control Box with up to 200A CCS, and the HVC CCS Control Box with up to 200A.

For more information visit **FleetMaintenance.com/53064137**

For medium- and heavy-duty engines

The **Diesel Variable Valve Actuation** from **Eaton Corporation** maintains aftertreatment temperature, maximizing an engine's thermodynamic efficiency for both medium- and heavy-duty engines. Eaton offers three variable valve actuation technologies, including Early or Late Intake Valve Closing (EIVC or LIVC) options, Cylinder Deactivation (CDA) technology, and an Early Exhaust Valve Opening (EEVO) option. Depending on the asset's needs, each valve solution can have hydraulic or electro-mechanical actuation, and each can be configured for overhead cam or overhead valve applications. The LIVC can offer improved fuel economy and a higher compression ratio, while the CDA reduces NOx by up to 90% when utilized with advanced aftertreatment, the company stated, and is compatible with Dynamic Skip Fire. Finally, the EEVO can open one or two valves and is compatible with engine brake and other variable valve actuation methods.

For more information visit **FleetMaintenance.com/53064104**

Designed for harsh environments

TireCheck's **Internal Strap Mounted TPMS Sensor**, No. 030878, is suitable for a variety of applications, including light-, medium-, and heavy-duty commercial vehicles and communicates via radio frequency to meet any fleet's tire pressure management system requirements. This strap mounted TPMS sensor utilizes velcro or elastic and measures 27 mm by 10 mm by 56 mm. With a battery lifetime of about five years, the sensor monitors tire pressure and temperature directly on the wheel, allowing it to send relevant tire data every two minutes.

For more information visit **FleetMaintenance.com/53064113**

Includes mounted cab display

The **Doran 360HD Tire Monitoring System** from **Doran Manufacturing** is designed for commercial trucks, trucks only, and truck-trailer combinations. Including a mounted display for in-the-cab tire monitoring, the system receives tire pressure and temperature data via radio frequency, which it then transmits from wireless sensors mounted that double as valve stem caps on each tire. Requiring 12/24 VDC for operation, the display features a digital LCD screen with a backlit display and audible and visual alarms which will display the specific tire locations with updated data. The sensors are set in a nylon housing and are powered with lithium-ion batteries with a design life of five years. Additionally, the system includes a remote antenna kit that can attach to the monitor and mount to the tractor's cross member for guaranteed reliable reception.

For more information visit **FleetMaintenance.com/53064118**

No adapters needed for fast installation

Continental's **ClearContact Synthetic Wiper Blades** feature dual-point coupler designs for uniform contact with the windshield in their year/make/model-specific wiper blades. The front wipers include 14 part numbers and range from 15-28", while the rear wiper includes 19 part numbers available in 10-16". The blade composition resists UV light and harsh conditions so that its synthetic rubber formula remains flexible throughout its service life.

For more information visit **FleetMaintenance.com/53064130**

Plug-n-play dash camera

The **ADPlus Dash Camera** from **HCSS** features both road- and cab-facing cameras in this plug-n-play dashcam solution. Utilizing a built-in AI processor to detect driving events, the ADPlus alerts the driver in real time of dangerous behaviors and uploads driving events to HCSS Telematics for review. To monitor potentially dangerous behaviors, the camera has a 6-axis g-sensor and includes dual SD card storage, HD and SD recording, and a low power sleep mode (<0.1W) to avoid battery drainage.

For more information visit **FleetMaintenance.com/53064124**

Two-stage filter in a variety of sizes

The **5 Micron Compressed Air Filters** from **Walmec North America** are two-stage filters for point-of-use filtering of liquids, oils, and other contaminants. When placed near the point of use, the first-stage filter separates liquids and dirt, dust, rust, and scale. The second stage removes remaining moisture and contaminants down to 5 microns. The automatic float drain expels all the collected liquids when an ounce or more has gathered. Filter sizes include flow ranges of 15 SCFM to 250 SCFM and pressure ratings of up to 250 PSI.

For more information visit **FleetMaintenance.com/53064160**

TOOLS & EQUIPMENT

A roundup of the latest tool and equipment offerings.

Improved wear and tear enhancements

The **Dannmar Updated Swing-Arm Tire Changers**, Nos. DT-50 and DT-50A, now include enhancements to improve wear and tear. The bead breaker blade received a rubber bump-stop to ensure a smooth arm return, reducing shock loading. The stainless steel and aluminum pneumatic cylinders received internal end-of-stroke cushions that protect the seals, wear band, and piston rod. Both tire changers feature a swing-arm design that facilitates quick loading, with steel clamps to efficiently handle 12" to 26" wheels, including low-profile and run-flat beads. For stiff sidewalls, the DT-50A adds a power-assist tower. The Dannmar tire changers' high-torque turntable with reverse-direction control enables fast tire swaps.

For more information visit **FleetMaintenance.com/53027965**

Performs DPF resets and regens

The **CanDo HD Mobile II** transforms a smartphone, iOS or Android, into a Classes 4-8 code scanner that can read and clear trouble codes, log live data, and perform DPF resets and regens for Detroit, Cummins, Paccar, Mack/Volvo, International, Isuzu, and Hino. It also has Caterpillar on- and off-highway coverage and works on OBD-II engine diagnostics for passenger cars and light trucks. The VCI comes with 6-, 9-, and 16-pin; CAT connectors; and free updates.

For more information visit **FleetMaintenance.com/53056997**

Available with or without IQuity

The **Thraxus Elite Safety Eyewear** from **Radians** are available with or without IQuity, Radians' intelligent anti-scratch, anti-fog technology. Both are engineered with the same patented edge design and cyclonic venting of the original high-performance Thraxus safety glass. To provide a custom fit on a variety of head shapes and sizes, Elite also features three-position ratcheting temples with a wire core that allows for more adjustability. A soft brow further boosts the comfort level. Thraxus Elite IQuity incorporates even more features to offer ANSI Z87.1+ high impact protection, D4 dust and D3 liquid splash protection, as well as X anti-fog performance.

For more information visit **FleetMaintenance.com/53027976**

Available in three colors

The **Matco Tools 16V Cordless Infinium 3/8" Sealed Head Ratchet Kits** feature a fully sealed ratchet head to protect inner components from dust and debris, increasing tool durability to extend the life of the ratchet. The sealed head also prevents torque loss due to head spread, sustaining tool power and efficiency. A one hand forward and reverse selector, located on the bottom of the tool head, makes directional changes easier when in tight spaces. It also features a high-power, trigger-activated LED to illuminate the work area as well as a durable aluminum and glass-filled nylon housing construction. Available in burgundy, green, and orange. Kits include tool, two batteries, charger, and nylon carry case.

For more information visit **FleetMaintenance.com/53042224**

Ideal for color matching and finding body flaws

The **NextLED Professional LED Color Matching Light**, No. NT-2040B-3, is ideal for color matching and spotting body flaws. With a CRI rating of 96+, it closely mimics natural sunlight, allowing users to precisely match paint colors and assisting in finding paint flaws before and after painting. It features three different color temperatures: 2700k, 4500k, and 6500k. Additionally, a mounting charging station, a hanging hook, and a built-in magnet are included.

For more information visit **FleetMaintenance.com/53042268**

Forged from one-piece steel construction

The **Mac Tools Anti-Vibe Hi-Vis Ball Peen Hammers** are ideal for metal-shaping and driving applications. Forged from one-piece steel construction, the ball peen hammers offer added durability. They also feature a tuning fork design to isolate vibration and bi-material grip construction to help reduce shock. Additionally, the handle provides a textured grip for slip resistance and increased comfort. The hi-vis hammers are available in sets and individually.

For more information visit **FleetMaintenance.com/53059057**

Ideal for low-resistance testing

The **MT03A Milliohm and Motor Tester** from **Pico Technology** offers resistance testing of all windings on a three-phase motor in under a minute, says the company. It's designed to meet the needs of technicians in a wide range of industries, including automotive, off-highway, heavy duty, rail, mining, and more. The tester and included sensor can execute earth-bond testing in compliance with UN ECE R100 regulations and a minimum test current of 200 mA.

For more information visit **FleetMaintenance.com/53059066**

Features a pocket clip and end-cap switch

The **Ledlenser P7R SE (Special Edition) Flashlight** has increased power (1,100 lm), a further beam distance (200m), and a 40-hour run time. It also includes the Ledlenser Advanced Focus System, for quick adjustment between a spot or flood without losing quality of light. It charges quickly with a floating charge system and wall-mounted charging cradle and can use alkaline batteries. The P7R SE also has a pocket clip, temperature control, and end cap switch.

For more information visit **FleetMaintenance.com/53060298**

Lightweight and easy to hold

Ingersoll Rand's IQV20 1/4" Compact Impact Driver delivers up to 3,400 lb.-in. of fastening torque. The compact driver is 5.2" tip-to-tail long and weighs less than 2.3 lb. for control and maneuverability in tight workspaces. The 1/4" hex drive has a quick release collet for use with impact-rated bits. The overmolded ergonomic grip provides comfort for extended periods of use. A patented 360-degree shadowless LED light ring illuminates the fastener from all sides. It includes a 3-year limited warranty and is available in a kit, W3111-K22, which includes one impact driver, one BL2023 battery, one BL2012 battery, and one battery charger.

For more information visit **FleetMaintenance.com/53058687**

Head flexes through 180 degrees

The **90-Tooth 12-Point GearBox Double Flex Ratcheting Wrenches** from **GEARWRENCH** deliver a 4-degree swing arch for improved access. With a longer, wider beam, the wrenches offer improved reach, leverage, and comfort. The head flexes through 180 degrees for adjustable access angles. Additionally, the ratcheting wrenches feature off-corner loading that reduces fastener rounding, large color markings for easy size identification, and full polish chrome. Available in two sets: 6-pc metric and 4-pc SAE.

For more information visit **FleetMaintenance.com/53059064**

ADVERTISER INDEX

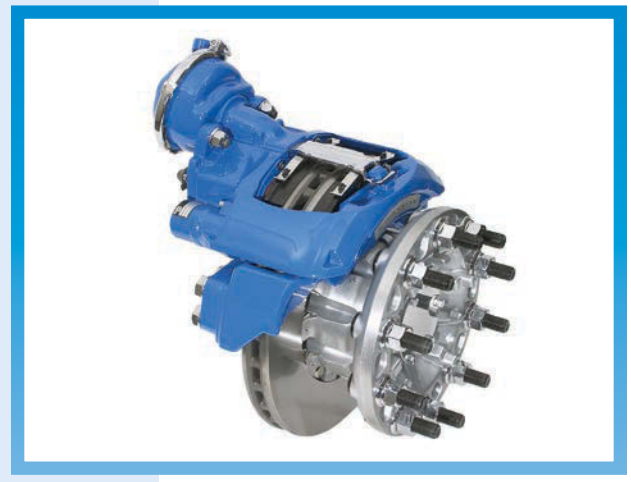
Wheel ends and brakes

Bendix ADB22X Air Disc Brakes

Bendix ADB22X air disc brakes use a floating caliper design to provide maximum braking power, shorter stopping distances, and improved safety on all axles of heavy commercial vehicles, buses, and trailers, the company said. It was designed to have longer service intervals and faster maintenance that help lower costs and downtime.

"We've spec'ed Bendix disc brakes for more than 10 years, and the drivers absolutely love them. They'll say, 'This thing brakes like a car. It grabs harder than drums, but it's smoother,'" said Russ Hull, director of maintenance at Tankstar USA. "I've never heard a driver wish they could go back to drum brakes."

For more information visit: **FleetMaintenance.com/53063947**



TetherTech Hub System

The **TetherTech Hub System** prevents wheel-off events by holding the wheels inward via aircraft-grade aluminum wheel-end fastening components connected via a steel cable that runs through the axle. Even if a lug nut fails, the system's clamping force keeps the wheel on. TetherTech works with certain automatic tire inflation systems, and installation takes less than an hour.

"While the benefit of avoiding wheel-off incidents at first seems to be the big selling point, I believe there are other, more justifiable opportunities to validate a true return on investment," said Bruce Stockton, COO of Wilson Logistics. "With tire costs one of the top two maintenance costs in any fleet's budget, TetherTech stands well positioned to justify a full ROI on the improved tire life by lowering a fleet's total cost of ownership through improved tire runout life per mile."

For more information visit: **FleetMaintenance.com/53063950**

SKF's TraX Wheel End Monitor

The **TraX Wheel End Monitor** by **SKF** provides an early warning of wheel bearing damage using a sensor unit on the truck wheel rim. It monitors vibration and temperature, alerting the driver of any potential wheel issues. Updates are sent wirelessly to the driver's smartphone, the SKF Cloud, or a third-party cloud, and to the fleet's maintenance location.

"Pilot has already caught two bearing failures before they became more serious issues," said Brent Hickman, senior manager, equipment, maintenance and fleet sales for Pilot Flying J. "Bearings are cheaper to replace than 'demolished' wheel ends. The trailer tells you when it has an issue with wheel-end temperature or vibration, and wheel-offs are one of the biggest safety issues on the road today."

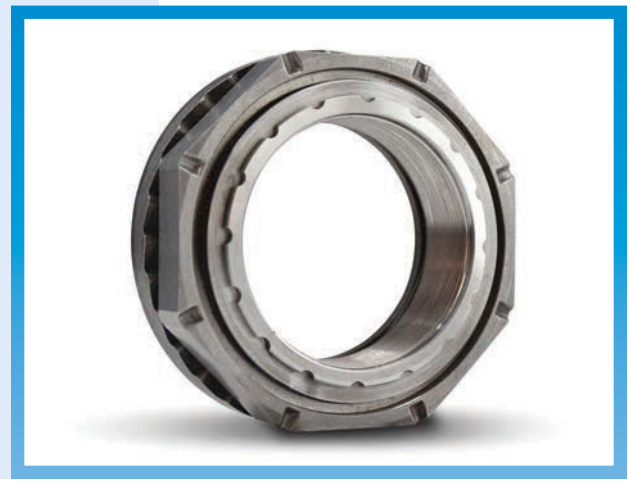
For more information visit: **FleetMaintenance.com/53063951**

Auto-Torq by Stemco

Stemco's Auto-Torq axle fastener is designed to streamline wheel end installation, eliminating the need for washers, clips, snap rings, screws, or keepers. Compatible with any industry hub manufacturer, the Auto-Torq securely applies the optimum clamp load on the bearings every time, according to the company.

"The integrated locking mechanism prevents backoff while still allowing easy removal for annual inspections and maintenance," said Scot Reeder, senior product manager at Stemco. "Auto-Torq, coming out later this year, will be offered in combination with the Stemco Discover XR seal."

For more information visit: **FleetMaintenance.com/53063952**



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