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*How to manage
technicians through*

MAINTENANCE PROCESS CHANGES

CHANGE MANAGEMENT

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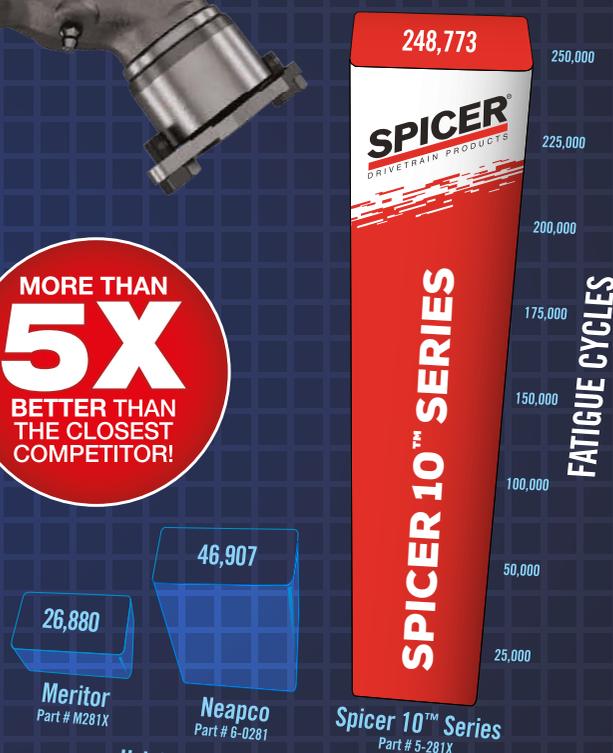


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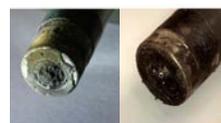
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BLOG



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Review your pre-trip inspection process

Have guidelines in place for drivers to help mitigate vehicle issues.



By Erica Schueller
Editor-in-chief



@FM_Editor



While enrolled in Waukesha County

Technical College's professional truck driving program to obtain my Class A commercial driver's license (CDL), I've been impressed with how thoroughly the instructors have educated incoming professional drivers for the trucking industry. Case in point, every student must learn how to conduct a complete pre-trip inspection.

During the second week of the 10-week program, we first learned about the process of how to inspect the tractor and trailer before getting behind the wheel.

Our instructor covered every area of the vehicle, beginning with the vehicle overview, the engine compartment, all sides of the tractor and trailer, the kingpin and fifth wheel and the cab. Not to mention, completing the LABS air brake test.

This introduction to the pre-trip inspection process took the class nearly two hours, going through every aspect of the vehicle. That first walkaround was like drinking from a firehose.

As a new student, it may be overwhelming at the beginning. But, through formal training, incoming drivers will have a comprehensive

understanding of how to complete a pre-trip inspection.

Since drivers should come with this prerequisite knowledge when they're hired, that means they're conducting a thorough pre-trip inspection every time they start their hours of service for the day, right?

This may not always be the case. Plus, for a driver who's been behind the wheel for a number of years, a refresher on pre-trip may not hurt either.

A review of the vehicle

Pre-trip inspections are designed to catch issues before they become a threat to the safety of others on the road. Do you provide in-house training, refresher information or updates for drivers, or any other additional resources to help ensure they're reviewing the vehicle on a regular basis?

Based on what I've studied for the formal pre-trip inspection exam, here are some areas you may consider for a pre-trip checklist:

Engine compartment and front of tractor.

A review of all components under the hood, including the critical fluids - power steering, engine oil, coolant and windshield washer fluid, as well as components such as the water pump, air compressor, alternator, the power steering linkage, etc. The driver must also review all aspects of the steer axle, including the suspension (typically leaf springs), brakes and tires.

Tractor side and rear. This covers a review of the sides and back of the tractor, including air hoses, exhaust and the catwalk. This also comprises examining one drive axle, including the suspension, brakes and tires.

Trailer side and rear. A review of the trailer header board, the back trailer doors and everything in between. This test also requires the review of one of the axles on the trailer tandems. Drivers must know how to inspect the suspension, brakes and tires.

Coupling device. While technically part of the tractor rear/trailer front inspection, the fifth wheel and kingpin have a separate checklist, which includes a review of the tractor portion (the fifth wheel/skid plate, slide locking pins and the pivot pin and release arm) as well as the trailer portion (the apron, or bottom of the trailer where the slide plate touches, and the king pin).

Cab check and engine start. The cab check should begin with a "safe start" - meaning before the vehicle is turned on, the driver must check to confirm the seat belt is in proper working order, and not frayed or damaged;

the vehicle is in neutral (here, you can also check the throws to confirm the distance for shifting); that there is about 1-1/2" to 2" of free play on the clutch; and that the parking brake is on (the red and yellow knobs are pulled out). Once the vehicle is turned on, the driver will check the windshield wipers, all gauges are in proper working order, that the heat and defrost work and vehicle lights are all working. This includes headlights, high beams, turn signals, hazards, brake lights and clearance lights. This is also the time when the truck builds air pressure for the air brakes, to complete the brake check.

Brake check. Drivers must have an understanding of the step-by-step process for ensuring all aspects of the air brake system are in proper working order. This is completed through the LABS test. LABS is an acronym which stands for leaks, alarms, buttons and service brake. The test takes less than five minutes, and allows drivers to confirm the air brake system is working properly before driving.

Safety equipment check. Drivers must confirm the cab includes a full fire extinguisher, three safety triangles and electrical fuses.

This list might provide your team with some areas to consider when it comes to creating a pre-trip checklist for incoming drivers, or a refresher for long-time veterans behind the wheel.

Follow up with refreshers and training

A thorough pre-trip needs to be done at the start of duty for the driver, before he or she operates the vehicle. This is not to mention en route and post-trip inspections.

Driver vehicle inspection reports (DVIR) round out the pre-trip process by alerting the maintenance staff to vehicle issues. A driver's ability to provide accurate details are key for this report.

In class, it's stressed that we don't need to know what each component does, or how to fix it. But, it is critical that drivers be able to assess and report any issues as a preventive measure before they become critical or catastrophic.

Communication between drivers and maintenance is also important in order to ensure repairs and service are completed quickly and accurately. What type of process do you have in place to educate drivers on both the pre-trip process, and the completion of DVIRs? ■



» Schueller is studying to earn her technical diploma for professional truck driving, and test for a Class A commercial driver's license.

E. Schueller

understanding of how to complete a pre-trip inspection.

While a real-life pre-trip should take a driver about 15 minutes, testing for the pre-trip inspection portion of the CDL test requires the driver to provide details on every aspect of the vehicle he or she is checking. The test can take about 45 minutes. Steps include pointing to each component or system of the vehicle, and stating out loud specifically what to look for to ensure there are no issues.



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HOW TO MANAGE TECHNICIANS through maintenance process changes

Change management helps fleets implement process changes with minimal operational disruption.

By Vesna Brajkovic, Assistant Editor

[TRAINING & RESOURCES]

Photo Courtesy of Rotary Lift

Think of a great idea, a process with a perfect application in a fleet. One that, when implemented, will surely decrease related downtime incidents. Think of the no-brainer decision, the small-effort, big-effect change that would improve a fleet's performance. Maybe it's as simple as adding another line to a preventive maintenance checklist. Sound "simple?" Maybe on paper.

Now, think of the most valuable veteran technician in that maintenance bay. Imagine they oppose that great idea. They've done this a million times and it's never been done like *that* before. They're reluctant, resistant. Maybe the technician implements the change, but hates every second of it. Morale decreases. And eventually, the idea fails and the cycle starts all over.

Who's to blame? The hard-headed technician who "hates" change, or the fleet's management who failed to properly manage the change?

➔ Continued Page 14



» Guide technicians through transitions and land on a sustainable implementation plan.

Photo courtesy of Rotary Lift

The answer: Fleet management.

“Resistance to change is because of lack of understanding,” explains George Williams, an instructor of the University of Wisconsin’s maintenance management certificate program and CEO of ReliabilityX, an asset management and operations consultant company.

Lack of understanding from the technician means ineffective communication and guidance from management. Perhaps lack of vision and poor planning also contribute.

Luckily, people are predictable when it comes to change, and that allows fleets to better prepare for future changes. The goal is to guide the team through the transitions and land on effective, evolving implementation that is sustainable for the fleet. This is called change management.

Change management can be broken down into two parts: management and leadership.

Management includes the process, tools and techniques used to ensure changes are sustainable for the fleet. Leadership is ensuring technicians are aligned with the change and motivated to implement it. For a change in the maintenance bay to be successful, fleets need both.

And it starts with the “change curve.”

Understand the “change curve”

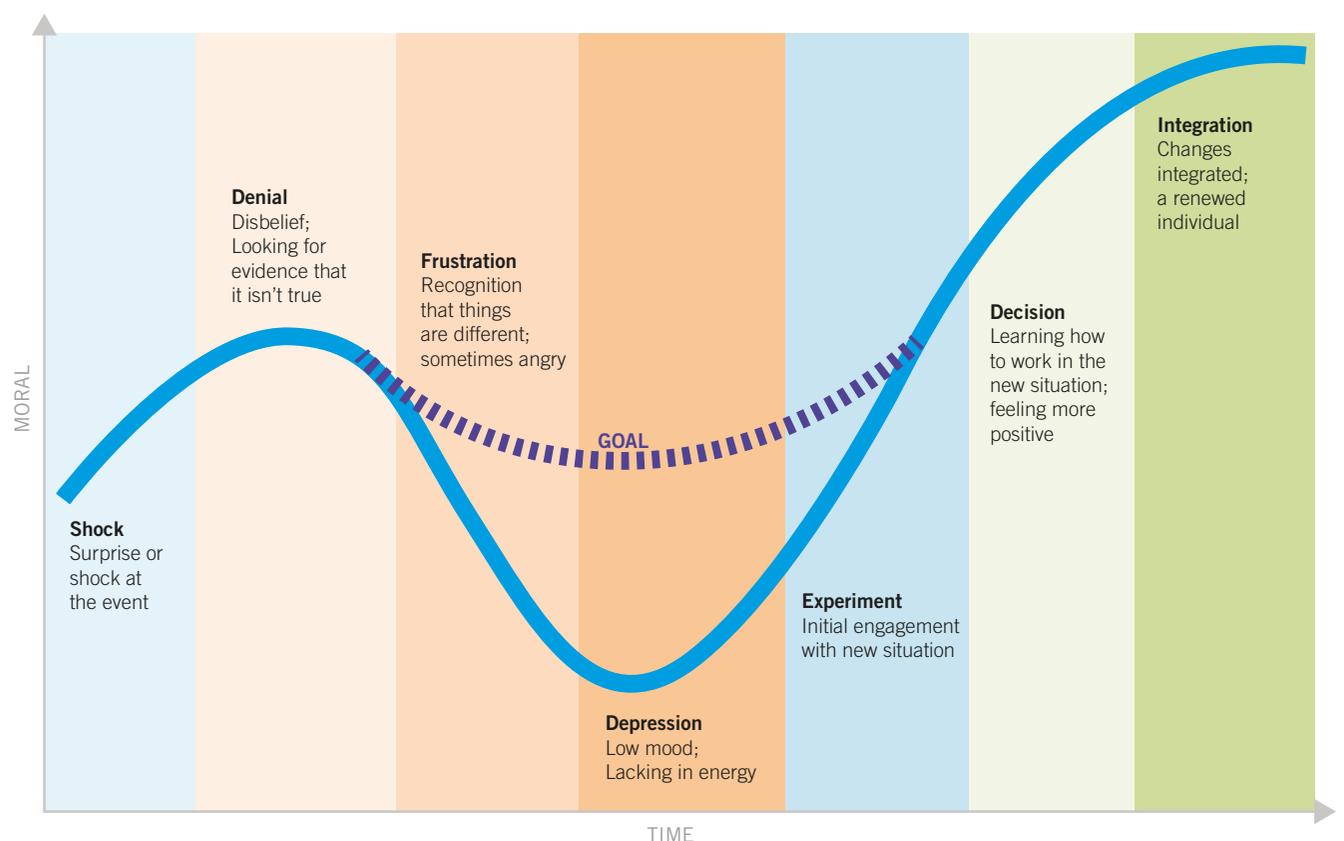
Resistance to change is a normal human response. It stems from fear of the unknown. In a perfect situation, technicians would embrace changing procedures with open arms every time. But, it’s important to always prepare for the worst-case scenario: technician resistance.

To prepare, the first step is understanding how humans respond to change. A common way to do this is to reference the Kubler-Ross model (See Fig. 1 below). The Kubler-Ross model is widely known as the “Five Stages of Grief.” When this model is translated into change management terms, it is known as a “change curve.”

The change curve illustrates how people will react

Change curve

(Fig. 1) The Kubler-Ross model is widely known as the “Five Stages of Grief.” When this model is translated into change management terms, it is known as a “change curve.” The goal of change management is to help lessen or shorten the negative stages most people go through when introduced to a change. (This is illustrated by the dotted blue line overlaid on the typical change curve.)



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when a change is introduced. The stages are: shock, denial, frustration, depression, experiment, decision and integration.

- ➔ Shock – A feeling of surprise or being caught off guard when a change is introduced.
- ➔ Denial – Disbelief the change is taking place. Often, the person will look for evidence that it will not take place.

» The goal is to find ways for everyone in the fleet to get on board with changes.

Photo courtesy of Paccar



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- ➔ Frustration – A person will recognize the differences because of the change, and sometimes become angry or frustrated by them.
- ➔ Depression – Low morale and low energy results from the frustration.
- ➔ Experiment – There will be initial engagement with the change.
- ➔ Decision – After engagement, people will learn how to work with the change and start to feel more positive about it.
- ➔ Integration – Finally, changes are willingly integrated into the workflow.

Guide technicians through the change curve

Once it is understood how technicians will react to a change, fleets can prepare to guide their team through every stage.

There are five stages of leadership which should 'combat' the stages of the change curve: vision, engagement, coaching, recognition and demonstration.

- ➔ Vision – Create a shared vision among employees by helping them understand the change, the reason for the change and the benefits of the change once implemented.
- ➔ Engagement – Explain the importance of the change. Do not give up when there is resistance.
- ➔ Coaching – A combination of support, challenge and direction. Help others achieve changes that may be difficult to implement into their workflow. Don't let obstacles get in the way.
- ➔ Recognition - Acknowledge achieve-

Lack of understanding from the technician means inefficient communication and guidance from management.

ment and continue to clarify the benefits of the change.

- ➔ Demonstration – Assure benefits have been gained from a change being implemented and that they will not be lost. Be a role model.
- Some technicians may sail through the change curve and others may get 'stuck' in a stage. The important thing is to find ways to get everyone in the fleet on board with the changes. If a fleet is doing "everything right" in communicating with a team member and they are still resisting, consider giving more consideration to their perspective. Was this person or department considered in the process to implement the change? Were they given time to respond, critique or provide input in the decision? If not, perhaps they are seeing something that's been missed, and in that case, it's important for them to be heard.

➔ Continued Page 19

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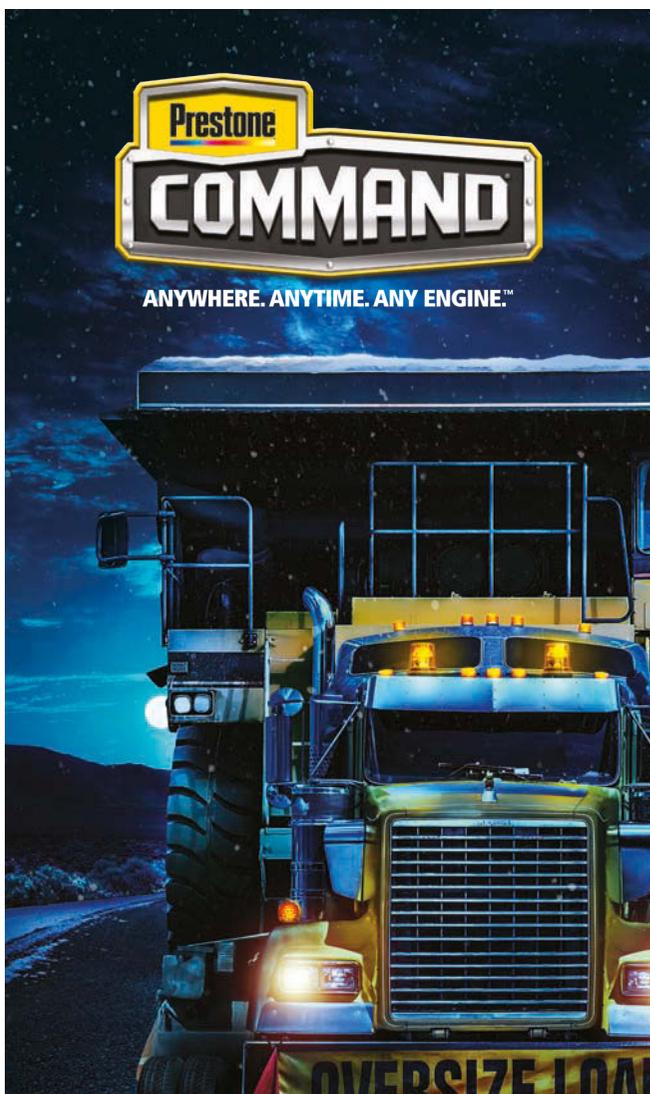
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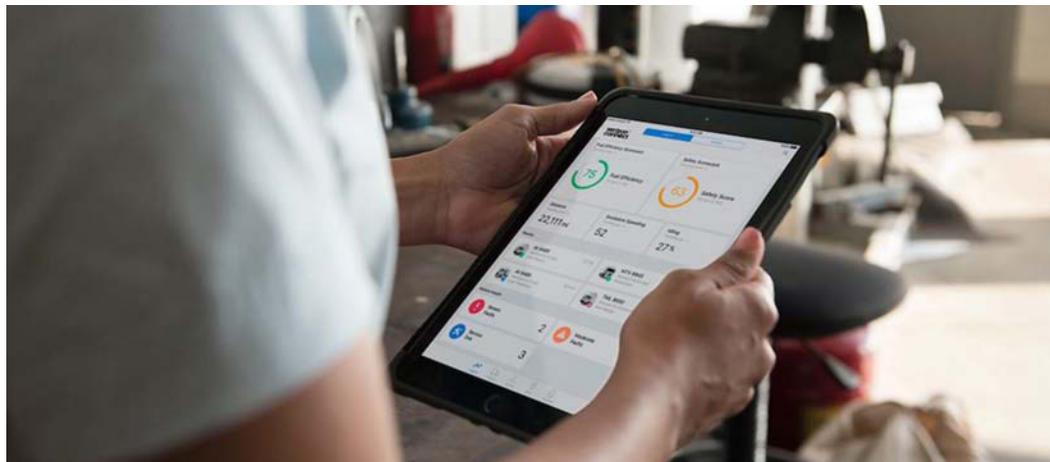
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» Maintenance management software (MMS) can help fleets find problem-spots in an existing process or draw attention to oversights in maintenance.

Photo courtesy of Verizon Connect

Find maintenance 'problem-spots' in a fleet using management software

Use the right data to help justify new and improved processes.

Introducing a change to the maintenance process begins with identifying a problem.

Maintenance management software (MMS) can help fleets find problem-spots in an existing process or draw attention to oversights in maintenance. Ultimately, the software can be used as a tool to implement solutions, justify them and keep track of their success.

"Problems" can pop up in maintenance processes after any change or introduction of new equipment, so it's important to routinely review these processes. Remember to plan for today's problems and for the future of the fleet by using data.

"Make sure that the software and partner that you choose helps you to optimize tomorrow, not just address today's problem," Dossier System's Bob Hausler, vice president of marketing and technology, says. Dossier Systems provides fleet maintenance management software solutions for the surface transportation industry.

Even without any obvious changes to maintenance processes, ReliabilityX CEO George Williams suggests a review of all processes at least every three years. ReliabilityX is an asset management and operations consultant company. Echoing that advice, Hausler says maintenance management software needs to adapt to anything that comes up in order to avoid downtime.

"Changing software can create a significant business interruption," Hausler says. "You don't want to buy something and then outgrow it in three years and have to start over."

JUSTIFY NEW PROCESSES

Oftentimes, the maintenance department can be seen as a cost center. When implementing a new process, it's possible there can be an increased cost or commitment, which could be met with resistance from stakeholders in an operation.

By using data from an MMS, fleets have a way to translate "problems" and "cost" into return on investment.

"Meeting with all internal parties involved in a true 'fleet maintenance' program for your company, and understanding all stakeholders and what they need from the tool, is a helpful exercise to come up with your real requirements [for an MMS]," says Vehicle Tracking Solutions' (VTS) Chief Technology Officer Ryan Wilkinson. VTS is a fleet tracking technology company which offers Silent Passenger, a cloud-hosted, web-based fleet management and fleet maintenance platform.

The data provided by an MMS can give leadership (and technicians in the bay) a reason to get onboard with an incentive. It converts a problem into a solution. And once there's a solution, fleets can start implementation.

"Analyzing that data and using it to take action is the payoff of having a good system," Dossier's Hausler says. "Good

maintenance software should be able to tell you everything from [preventive maintenance] compliance, to which techs do best against your standard repair time, to life-cycle replacement projections for your assets. Don't just look for the reports that are needed immediately, look at the library of available reports to see what could help your fleet operation in the future."

Hausler offers one example of how using data can benefit a fleet: having integrated use of VMRS codes.

"Having parts and labor properly coded will identify where the money and time are going and provides the information needed to analyze problems and spot trends," Hausler says.

Software can also give fleets support for introducing preventive maintenance practices which may be out of the purview of the maintenance department.

Features for tracking driver habits have been helpful to maintenance managers, because drive styles directly impact the life of brakes and tires, says Verizon Connect's fleet management solutions engineer Chris Ransom.

"There's been an increased focus as the industry's begun to realize [fleet management software is] not just about being able to set reminders and understanding when your vehicles have a problem," Ransom says. "Those are all really important, but now [fleets] can be proactive about things beforehand from a driving styles standpoint."

Anchor change in work culture

When a process change is introduced in a fleet, it may initially be demotivating. But, remember, if it were never introduced, the process would remain stagnant. Goals and changes force operations to think critically about their performance.

In general, all processes should be reviewed after every significant change to the business and introduction of new equipment, or every three years, advises ReliabilityX's Williams.

(See sidebar 'Find maintenance 'problem-spots' in a fleet using management software' for more information on how data can help justify process changes.)

When reviewing the current process and setting new goals, be sure to develop clear expectations which will be communicated effectively to the staff.

"Otherwise you are unfairly measuring them against a yardstick they don't know exists," Williams says.

As technicians warm up to the idea of a change through guidance from fleet management, they will advance through four steps of engagement: awareness, understanding, buy-in and ownership.

➔ Awareness ("I heard it.") - Realize a change is taking place. During this stage of engagement, technicians have some knowledge of the change, develop a view of the change based on their personal position and will ask questions.

➔ Understanding ("I get it.") - Know the rationales and implications of the change. In this stage, technicians have realistic expectations of what the change will deliver and when. They understand the rationale and implications behind the change, and know what they need to do.

➔ Buy-in ("I live it.") - Behaviors shift and skills develop. Technicians will start to agree with the change in this stage. They will adjust their workflow to implement the change and participate in discussions related to the change. They will also respond quickly to requests related to the change using new skills and approaches. Technicians will also deliver feedback about the change back to the fleet.

➔ Ownership ("I own it.") - Those that implement the change now help others do the same. This stage is the end goal.

Technicians now take ownership of the efforts and the success it brings. They start to help other technicians make decisions and take actions aligned with the change, and support the outcome. In this stage, technicians will independently spread the message of the change and its process to others in the fleet.

By understanding and anticipating the natural

stages of resistance when introducing changes into the maintenance bay, fleets can better prepare technicians for transitions in their workflow and guide them along the change curve. ▀

INFORMATION GATHERED from the University of Wisconsin-Madison College of Engineering's Professional Development course "Maintenance Management 101," taught by George Williams.



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Improve efficiency with trailer **AERODYNAMICS**

Reducing aerodynamic drag on the trailer can translate to improved fuel economy and operational efficiency.

By Stefanie Von Rueden, Assistant Editor

[AERODYNAMIC DEVICES & SYSTEMS]

As U.S. EPA emission standards become more stringent and fleets are pressured to become increasingly more fuel efficient, trailer aerodynamic devices can offer a solution to improve overall vehicle efficiency. “Aerodynamics matter,” says Steve Ingham,

CEO of trailer aerodynamic supplier SmartTruck. “The aerodynamics of the tractor-trailer system has a direct effect on the overall performance and operational efficiency of the system.”

As a truck and trailer drives down the highway, it encounters resistance, or drag, from the air flowing at and around it. Oncoming air flow on the front of the tractor creates a high pressure area. This creates three main areas of drag on the trailer: the front of the trailer at the top, by the trailer gap; the undercarriage of the trailer; and the back of the trailer by the doors. These areas of drag create resistance that pulls the vehicle backwards as it is trying to move forwards, increasing strain on the engine and drivetrain, says Drake Piper, category director for ITMS at STEMCO. STEMCO is the supplier of a diverse line of high performance systems and components to



» Aerodynamic devices can help improve fuel economy and overall vehicle efficiency.

Photo courtesy of Great Dane

the commercial vehicle industry. The Innovative Tire and Mileage Solutions (ITMS) division of STEMCO provides solutions to increase fuel efficiency, reduce maintenance costs and increase roadway safety.

Trailer aerodynamic solutions work by decreasing aerodynamic drag on the trailer, which in turn reduces strain on the engine, helping to improve fuel economy and operational efficiency.

Types of aerodynamic solutions

Trailer aerodynamic solutions are not a one-size-fits-all purchase. The types of devices that make sense for a fleet will depend largely on



» Wheel covers and mudflaps help reduce turbulence and drag around the wheels.

Photo courtesy of FlowBelow

application, vehicle type, the type of terrain the vehicle drives on and more. In many cases, these solutions are customizable to fit the use of the tractor and trailer.

“[For example,] we have one component that’s fundamentally focused on dry vans,” says SmartTruck’s Ingham. “It can’t be put on a refrigerated trailer because of the refrigerated unit on the front. With different types of personalized features on trailers, we are able to customize aerodynamic solutions around that.”

Other factors to consider are whether the device will work with the trailer specs, including length and height, and with work performance devices such as liftgates, ramp operations and different types of doors, adds Chris Lee, vice president of engineering for Great Dane. Great Dane is a manufacturer of truck dry van, refrigerated van and flatbed semi-trailers.

Here is a basic overview of each of the basic trailer aerodynamic devices, and which area of drag they help to reduce:

- *Side skirts*—Help reduce aerodynamic drag under the trailer where air hits the trailer’s rear axles. These devices help guide air around the sides and to the back of the trailer.
- *Trailer tails*—Help minimize the low-pressure vacuum that occurs directly behind the trailer. This is typically the area that creates the largest amount of drag, so improving the aerodynamics of this part of the trailer can help improve vehicle stability and fuel efficiency.
- *Nose fairings and gap reducers*—Designed to fill the area between the tractor and the front of a dry trailer, helping to shield from crosswinds and reduce drag on the front of the trailer.
- *Wheel covers and mudflaps*—Help reduce turbulence and drag around the wheels, which helps improve fuel efficiency.

Often, different types of aerodynamic devices will complement each other. For instance, a fleet may choose to use a trailer tail and a side skirt to address both undercarriage drag and drag at the rear of the trailer. Employing one aerodynamic device does not preclude a fleet from installing another.



» It is important to consider whether the aerodynamic device is suitable for the application.

Photo courtesy of SmartTruck

Trailer aerodynamic solutions are not a one-size-fits-all purchase.

Fleets have the option of installing aerodynamic solutions piecemeal, or selecting an aerodynamic trailer solution kit.

“Michelin offers a kit for use on 53’ dry-van truck load, refrigerated truck load and other long haul and super regional applications,” notes

Calvin Bradley, aerodynamics technical lead for Michelin North America. “This integrated kit eliminates the need to combine elements from various vendors. Solutions put together from different parts that someone combines may not necessarily work together, and therefore, may not deliver the expected results.”

While known for tires in nearly every tire market, Michelin North America also manufactures aerodynamic devices. The company recently introduced an aerodynamic trailer kit at the Technology & Maintenance Council’s Annual Meeting earlier this year.

“Kits are only successful to the extent that it makes sense for the fleet to buy all of the components of the kit together,” adds Josh Butler, president of vehicle aerodynamics device provider FlowBelow. “For example, if the kit is validated to provide a certain fuel economy, and the components of the kit are designed to work well together.” When a kit is proven to work for the fleet’s application, it takes the guesswork out of deciding which aerodynamic options from which manufacturers are going to work well together to achieve the desired efficiencies. These all-inclusive kits can simplify the buying process.

On the other hand, aerodynamic kits do not offer the same degree of customization that selecting solutions individually might offer.

“When selecting aerodynamic devices for trailers, fleets should work closely with aero device suppliers and trailer OEMs to get the most effective solutions for their operations,” Lee suggests. “One-size-fits-all approaches will not work [as effectively].”

To ensure they select appropriate aerodynamic devices for their equipment and operational needs, fleets should consider discussing their options with the OEM and the device provider. They will be able to help determine whether a kit or a more customized approach is appropriate for the fleet’s unique operation.

What to look for in an effective aerodynamic solution

Improving fuel efficiency and overall vehicle efficiency is a worthy goal, but fleets also need to consider whether a particular device will



» Aerodynamic devices can be a branding tool that helps promote the carrier’s image.

Photo courtesy of FlowBelow

offer a good return on investment. Ideally, fleets should be able to see a return on their aerodynamic investments within two years or less, says FlowBelow's Butler.

He suggests looking for the following qualities when selecting aerodynamic devices:

- **Durability/life expectancy**—How does the equipment perform in extreme conditions and over time?
- **Compatibility**—Is the product compatible with other aero products already employed?
- **Functionality**—Will the equipment function reliably?
- **Support**—Does the company offer customer support? Can they support the product in the field?
- **Driver interaction**—Does the equipment function all the time, or does the driver need to deploy?
- **Maintenance**—How much money and time does it cost to maintain the product, and can it be easily maintained in-house? Are replacement parts readily available?
- **Aesthetics**—How does the product impact the company brand identity or the look of the fleet?

"Look for real return on investment testing by third party test verification," adds STEMCO's Piper. "[The company] should be able to stand behind their product with a strong warranty, in-field support and proven product life cycle."

Consider how the device was developed and tested, what the components are made of and what the company's research and development process looks like. If they claim to improve fuel efficiency by a certain percent, what kind of testing did they use to determine that efficiency? Is it backed by customer tests to validate the performance? Generally, the more thorough the company's testing process is, the more certain the fleet can be that the product will work as expected.

Also consider the amount of maintenance the device will require, the added weight of the device and whether those compare to the benefits to get an idea of what the total cost of ownership will be. "Aerodynamic solutions should cut fuel costs without increasing maintenance costs

or requiring driver attention or costly repairs," Michelin's Bradley says.

SmartTruck's Ingham adds that fleets need to consider what aerodynamic solutions they have already employed, and whether a new device would add to that benefit. "There is a practical limit," Ingham says. "You can't improve the same aerodynamic problem twice. So, fleets need to be smart about how they can be as efficient as possible."

Installation options

Fleets have three options when it comes to installing aerodynamic devices: they can spec them as part of a new trailer order, retrofit in their own shop or have the aero device provider professionally install.

"Normally, aerodynamic device installation is done by trailer OEMs, branches or dealers," Great Dane's Lee says. "Third party installation

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through repair shops or subcontractors is also an option.”

For fleets that elect to install in their own facilities, most aerodynamic device manufacturers offer support materials and detailed instructions for installation. “[Our system] can be installed in under an hour by either the fleet’s maintenance/service crews,

» Many fleets initially installed trailer skirts to comply with California’s SmartWay certified trailers mandate.

Photo courtesy of FlowBelow



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or by their trailer dealer,” FlowBelow’s Butler says.

But, SmartTruck’s Ingham adds that in most cases, fleets decide to spec aerodynamic devices with the purchase of a new trailer, so it makes the most sense for the trailer OEM to install the device. “One of the trigger mechanisms for making decisions about aerodynamics is the purchase of a new trailer,” Ingham explains. “All of our devices can be installed online when the trailer is manufactured, so there is no extra effort required on the part of the purchaser when it’s associated with a new trailer purchase.”

Fleets also have the option to work with a third-party installation professional that has been trained by the aerodynamic device provider. Manufacturers may offer a network of providers who are able to install aerodynamic devices for fleets who are adding them to trailers they already have.

Aerodynamic device maintenance

Aerodynamic devices should be inspected at regular intervals to ensure that everything is functioning properly and there is no visible damage.

“We recommend that everything is looked at during all scheduled intervals or service,” says STEMCO’s Piper. “Our

Check aerodynamic devices for structural damage and wear at regular intervals.

history shows less than \$30 a year in parts average during the life of the product.”

“Regularly scheduled maintenance is recommended per the aerodynamic device supplier’s recommendation,” adds Great Dane’s Lee.

During inspections, fleets should check for structural damage and signs of wear and tear. Also check bolts and brackets to ensure that everything has remained tight during use. Any safety concerns should be addressed during maintenance.

The future of aerodynamics

Improving truck and trailer aerodynamics is not a new concept, but the industry is just starting to see an increased adoption of these devices. Much of that initial adoption was mandated by government

» Trailer tails help minimize the low-pressure vacuum that occurs directly behind the trailer.

Photo courtesy of STEMCO



regulations. The U.S. EPA Greenhouse Gas Phase 2 regulations included aerodynamics as part of its rulemaking, and in 2008, the California Air Resources Board mandated the use of SmartWay-certified tractors and trailers driven in the state of California. Regulations such as these have driven the initial investment in trailer aerodynamics. As these regulations continue to dictate that fleets become increasingly efficient, aerodynamic devices are an option for fleets to meet these efficiency standards.

"There have been and still are in place regulations that require some level of aerodynamics," SmartTruck's Ingham says. "Let's say, for example, that a fleet put skirts on their trailer so they can be compliant and go into and out of California. They will notice a modest improvement in fuel economy as part of that, and will be more open to other aerodynamic devices moving forward."

While adoption of aerodynamic devices was mandated by regulations initially, SmartTruck anticipates that future adoption will be driven by a desire to improve efficiency, because the initial devices helped improve fuel efficiency.

"We foresee a trend of trailer manufacturers providing complete aerodynamic devices as an option at build," adds STEMCO's Piper.

This trend will be compounded as the industry explores alternative fuel sources such as electric vehicles, which are currently limited by their range between charges. Improving overall vehicle efficiency can help extend the range a vehicle can travel on the same amount of fuel. "That fuel in an electric truck is juice out of the battery," Ingham explains. "One of the ways you manage the size of the battery is to make sure that the tractor trailer system is as aerodynamic as possible."

"[Another] trend in trailer aero products is toward eliminating driver involvement," FlowBelow's Butler says. Drivers have enough to worry about already, without needing to deploy aerodynamic devices at highway speeds and monitor that those (devices) are operating correctly. Aerodynamic device manufacturers are

working towards developing low-maintenance devices that don't require driver input.

"Fleets should expect to see more robust and efficient aero devices on trailers with little-to-no maintenance in the future," Great Dane's Lee adds.

Aerodynamics offers a solution to the efficiency challenges that fleets are currently facing. The economy is dependent on the trucking industry, and the structure of the industry isn't likely to

change anytime soon, Ingham says. So, the question becomes, how can trucks and trailers be as efficient as possible, while still offering a good return on investment?

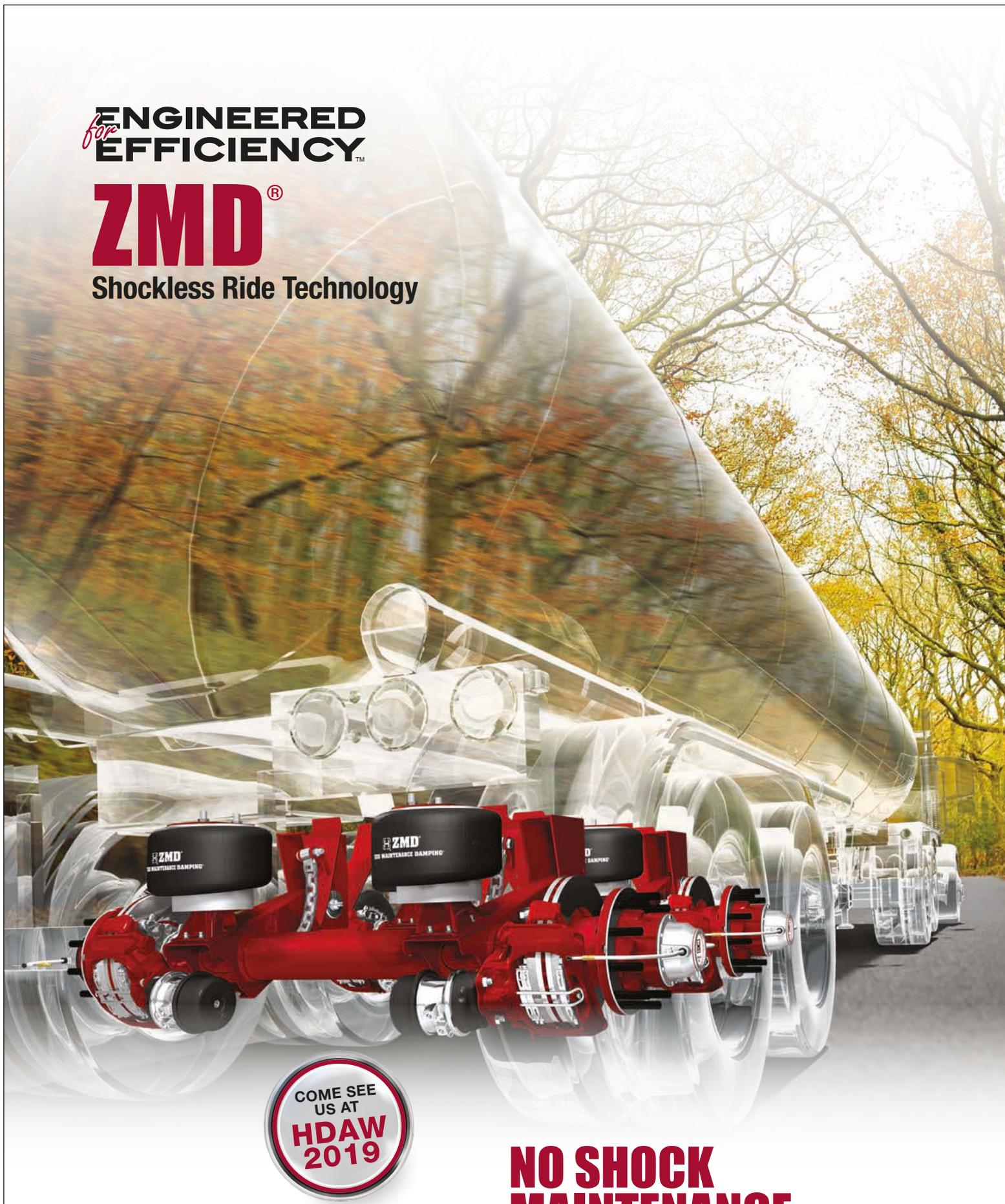
"The point is, aerodynamics matter, and they're going to continue to matter for a long time," Ingham concludes. ▀

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What's your engine aftertreatment service plan look like?

Stop avoiding aftertreatment service and face it head on by asking the right questions and following proper procedures.

By Erica Schueller, Editor-in-Chief

[ENGINE & DRIVETRAIN]

Do you know the failure rate for your aftertreatment systems? You'd be surprised how many fleets don't. "It used to be that exhaust was way down the line items on expense for a fleet," says Randy Griffith, sales and tech manager for Emission & Cooling Solutions. "Now it's up there with oil and tires and fuel."

Emission & Cooling Solutions works with fleets to implement training and DPF service programs for heavy duty aftertreatment systems.

"We preach total aftertreatment cost," he says. "It's not about the cost of the [DPF] cleaning as much as it is how much is it costing to maintain your entire fleet on this segment?"

Overview of the aftertreatment system

Beginning in calendar year 2007, heavy duty diesel-powered vehicles began using exhaust aftertreatment technology to meet more stringent U.S. Environmental Protection Agency (EPA) on-highway emissions standards.

The updated emissions standards included a significant reduction in particulate matter and nitrogen oxide (NOx) emissions emitted from heavy duty diesel vehicles. Particulate matter includes soot, unburned hydrocarbons, ash or sulfate.

The particulate matter emission standard took full effect in 2007. The NOx standard was phased in for diesel engines between 2007 and 2010.

Diesel engines with aftertreatment systems must use ultra-low sulfur diesel (ULSD) — which was another U.S. EPA standard designed to help

reduce pollutants in conjunction with limiting emissions. If a higher concentration of sulfur is in the fuel, it could cause damage to the aftertreatment system.

Heavy duty diesel engine aftertreatment systems were introduced as a solution to aid in reducing both particulate matter and NOx emissions since the pre-2007 fuel system, air handling and combustion technologies were unable to complete this task up to government standards.

Generally speaking, the heavy duty diesel engine aftertreatment system has two primary components: the exhaust aftertreatment technology — which includes the diesel oxidation catalyst (DOC) and diesel particulate filter (DPF) — to reduce and mitigate particulate matter;



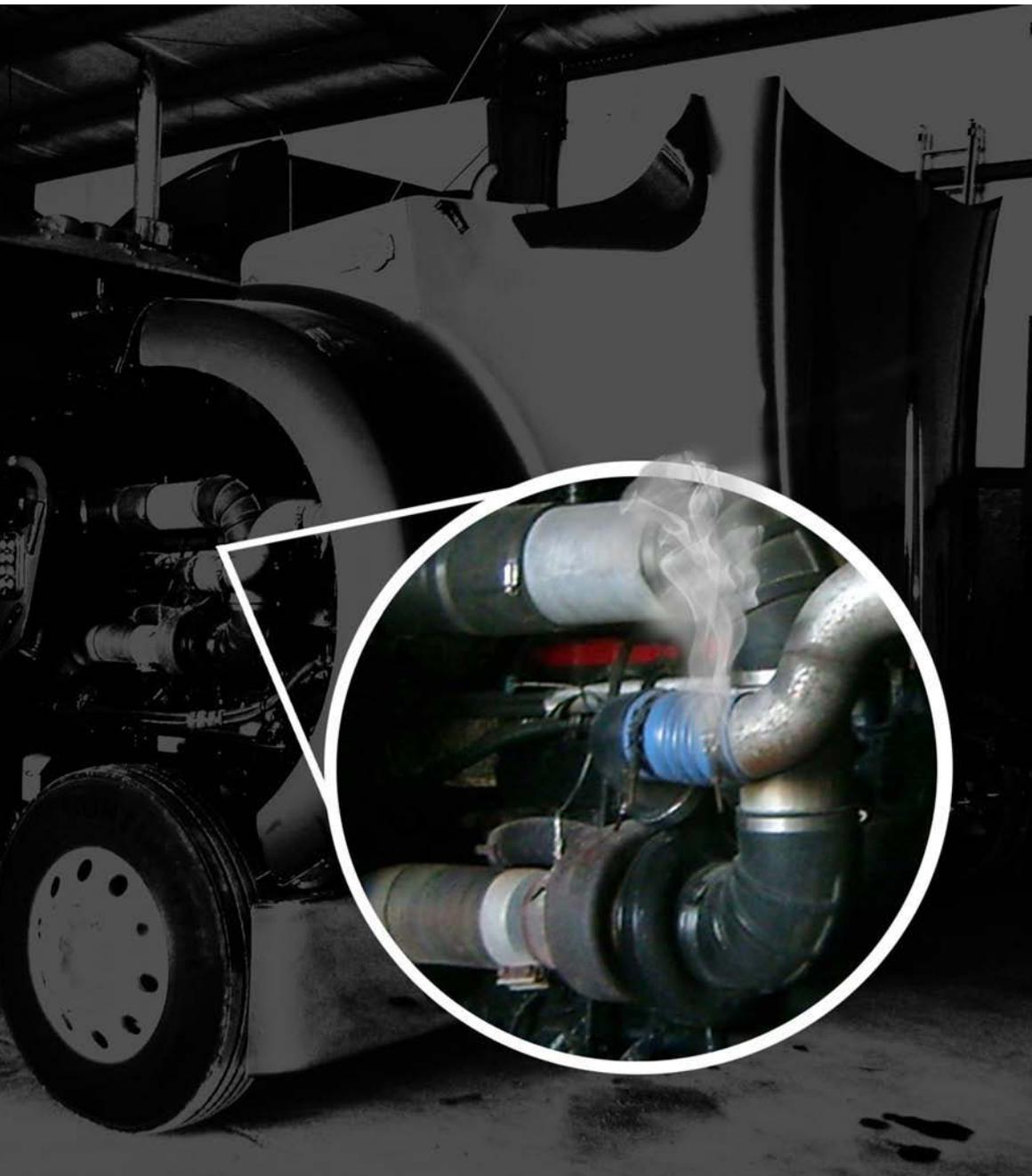
» Air intake issues, such as a leak, can cause a decrease in air volume further down the system.

Photo courtesy of Redline Emissions



» A high-pressure smoke machine can aid in diagnosing an air leak, according to Randy Griffith of Emission & Cooling Solutions.

Photo courtesy of Redline Emissions



Parts of the aftertreatment system explained

Randy Griffith, Sales & Tech Manager for Emission & Cooling Solutions provides details on the definitions for each aspect of the engine aftertreatment system in commercial vehicle diesel engines:

DIESEL OXIDATION CATALYST (DOC)

"The DOC is the first thing you get to coming off of the turbo in the emissions system, as far as big components," Griffith explains. "The DOC's sole purpose is to bring up the temperature in the exhaust system to create the reaction from soot, which is a bigger carbon, into ash, which is a smaller carbon."

The smaller particles can be more easily stored in the filtration system, or diesel particulate filter (DPF).

DIESEL PARTICULATE FILTER (DPF)

Diesel engine manufacturers have selected DPF technology as their prime path for reducing particulate emissions. The DPF accomplishes this by mechanically filtering the exhaust gases.

Griffith equates the DPF to a trash can, which collects the residual particles that have been heated by the DOC.

"I always use the analogy, if you take a 55-gallon drum, and you fill it full of trash, and then you light it, at the end of that burn you're going to have a layer of stuff that can't be burned," Griffith explains. "If you do that a thousand times, you've got a whole bunch of stuff that can't be burned that fills up your trash can. You have to pull it out and dump the trash can."

"DPF cleaning is basically the dumping of the trash can. The taking out of that stuff that can't be burned anymore or reduced in size."

SELECT CATALYTIC REDUCTION (SCR) SYSTEMS

Implemented in 2010 and newer heavy duty diesel vehicles, the select catalytic reduction (SCR) system allows commercial vehicles to reduce NOx emissions. This is done through an oxidation process, with the use of diesel exhaust fluid.

and a select catalytic reduction (SCR) system to reduce NOx emissions.

"Diesel-powered commercial equipment manufactured beginning in 2007 contained the DOC and DPF only," explains Gilbert Ramirez, manager, heavy duty product management at Denso. "The EPA introduced the [2010 greenhouse gas emissions] requirements to eliminate NOx from the emission stream in 2010, which led to the inclusion of the SCR to the aftertreatment system."

Denso, a supplier of OEM and aftermarket vehicle parts, and AP Emissions Technologies, a global manufacturer and distributor of vehicle emissions control systems and products, have partnered to manufacture and market a new line of OE-quality DPF and DOC products for heavy duty on-road and off-road vehicles and equipment.

"What the DOC does is it changes the chemistry in the exhaust stream and utilizes heat to burn the soot into ash, and the DPF stores the ash until it's time to clean and have it removed," says John Lightner, Cummins technical sales support manager. "The SCR system, through a chemical reaction, by the introduction of the diesel exhaust fluid (DEF), changes the chemistry and eliminates the NOx and greenhouse gases, so that you have [a little water and nitro-

gen] coming out of the tailpipe. You're not having the carbon dioxide coming out that gives you the greenhouse gas."

Cummins designs, distributes and services diesel and natural gas engines and related technologies, including fuel system, controls, air handling, filtration, emission solutions and electrical power generation systems.

The Technology & Maintenance Council's (TMC) Recommended Practice (RP) 355 on Maintenance and Inspection Guidelines for OEM-Installed Exhaust Particulate Filters for Diesel-Powered Vehicles provides details on the numerous original equipment diesel particulate filter (DPF) technologies for heavy duty commercial vehicle diesel engines. In addition, RP 355 offers information about how the DPF works, and details on how to maintain the system and diagnose issues.

According to RP 355, the aftertreatment system can help reduce particulate matter through a number of methods, including:

- ➔ Improved air management (e.g. optimized turbocharger)
- ➔ Improved combustion system (e.g. combustion bowl shape and location)
- ➔ Improved oil control (e.g. piston ring design and cylinder bore honing)

- ➔ Improved injection system (e.g. optimized injection duration, optimized injector hole size)
- ➔ Rated speed optimization (e.g. rated engine speed)

Find the root cause of aftertreatment issues

While traditionally many have pointed to the DPF as the cause of aftertreatment issues, fleets should note problems with the DPF are typically symptomatic of an issue further upstream in the system.

"If your engine is not running correctly, then it's going to emit more emissions and can plug up your filter and create more maintenance," says Cummins' Lightner.

There are two areas to address when it comes to servicing the aftertreatment system: proper diagnosis, and routine maintenance. Emission & Cooling Solutions' Griffith advises setting a

proper preventive maintenance (PM) schedule for the aftertreatment system is vital to the efficient operation of the vehicle.

When addressing what's thought to be a filter issue, "everybody does one of two things: they either point at the filter and say, 'that filter's bad,' or they do a manual regen to try to get the truck back up and running and send it down the road, and they don't address the issue that's going on with the truck," Griffith advises.

A regeneration is completed on the DPF when the filter has reached a certain saturation level, monitored by the engine control unit (ECU).

There are three types of regeneration that can be done: a passive regeneration automatically completed by the vehicle, an active regeneration manually initiated by the driver, or a forced regeneration done by a technician in the shop using a scan tool. Regardless of the type of regeneration, there are two requirements for proper regeneration of the system: adequate air volume and proper temperature.

When in the shop, a scan tool can be used to confirm air measurements and proper temperature for diagnosing issues with the aftertreatment system and DPF.

Air volume aids in pushing the particulate matter through the DPF; a hot enough temperature allows the system to burn the soot into ash.

Griffith notes that air intake issues, such as a leak, can cause a decrease in air volume further down the system. A high-pressure smoke machine can aid in diagnosing an air leak, he says.

"The number one thing that we find that causes premature issues [with engine aftertreatment servicing] can be pointed back to an intake or exhaust leak," Griffith says. "Or, a leak in the system with clamps and gaskets."

"It used to be, you could find an exhaust leak really easily because you had a whole bunch of black soot around wherever it was that was leaking," Griffith adds. "That's not so much the case anymore. Making air visible using a smoke machine to make sure that your clamps and gaskets seat well is really important. If you get air in the system that hasn't been heated through the DOC or a loss of back pressure due to the leak, you're going to have problems."

When it comes to high enough temperatures, Griffith says some fleets may see a drop in system temperature if they do not properly re-insulate the exhaust pipe after service.

Conversely, the system can also run too hot, particularly when there may be a leak upstream, according to Denso's Ramirez.

If more oxygen is accessible to the system through these leaks, it "can result in an overly rich mixture reaching the aftertreatment equipment," Ramirez says.

"This causes higher-than-normal heat, which can lead to destroying the PM coating and melting the substrate," he adds.

Temperature readings, measured with exhaust temperature sensors, are a key indicator in diagnosing an issue within the aftertreatment system.

"We don't want to have too big of a temperature drop across the face of the DPF," Griffith says. "As far as diagnostics go, DOC outlet and DPF inlet sensors are the first place to check to ensure a proper regen is taking place."

"A lot of times we can start diagnosing by look-

Heating options to reduce service requirements on the DPF



» In addition to reducing fuel consumption, an air heater also removes the DPF from the warm-up process, helping to prolong its life. By not idling the main power unit, a driver doesn't need to worry about the DPF not achieving the proper temperature to actively regenerate and clean itself.

Photo courtesy of Webasto



» A coolant heater, such as the Webasto Thermo Top C, warms the coolant helping to bring the engine up to operating temperature. According to Webasto officials, pre-heating the engine can help reduce the number of service intervals for the DPF.

ing at the temperature sensors," he explains. "On a DOC, you have to have a temperature of 600 degrees F to get the ramp up and the catalyst effect, to get that exhaust really hot. We'll use the front temperature sensor to make sure that we're getting that temperature that we need to make the ramp up happen, then after the DOC on the inlet of the DPF, we look at that temperature and make sure we're getting enough heat — somewhere around 1,000 degrees F on the inlet side of the DPF — and then we look at the outlet side of the DPF to make sure we've got some temperature coming through there."

Also as it relates to sensors, additional sensors used in the aftertreatment system include the pressure differential sensor, used to measure the current capacity of the DPF, and the NOx sensors.

"You have one [NOx sensor] at the turbo outlet, and you have one at the tailpipe outlet of the SCR," explains Cummins' Lightner. "What those are doing is measuring how much oxygen is in the exhaust flow, as well as how much NOx is in the exhaust flow, and it determines how much [DEF] needs to be injected to eliminate the NOx level at the tailpipe."

"The number one sensors that we're seeing people having problems with are the NOx sensors," Griffith adds. "[There's one] on the inlet side and one on the outlet side, and there's been some talk in the industry about having problems with the NOx sensors on the outlet side being caused by water that falls in the stack if it's got a vertical exhaust ... If you get a lot of water in the exhaust — of course, water and electricity don't really work together very well."

Proper DPF management and maintenance

As part of a regular PM program, DPF management can be handled through four options: filter exchange programs, cleaning the filters in-house, cleaning with a service provider or replacing with new filters.

DPF exchange programs are designed to allow fleets to send used filter cores to be remanufactured. This can help alleviate cost, but Emission & Cooling Solutions' Griffith suggests understanding the details of the exchange program to be aware of the history of each remanufactured filter.

"The primary benefit of the exchange program is uptime, assuming the exchange unit is available," adds Denso's Ramirez. "The risk is the unknown history of the core, which could contain multiple cleaning events."

"When you get a reman filter, there's no way to know what happened to that filter along the way," says Griffith. "You don't know how many miles are on it, you don't know any of that." Griffith suggests confirming the cores sent in are the same cores sent back, and that is done through a service provider like Emission & Cooling Solutions. "[Fleets] can tie it back to a unit, and they know if there was an EGR cooler that leaked on that truck [for example]. Or, if you're having trouble with a specific truck, you can track that filter through your fleet."

When utilizing an exchange program, Duane Bratvold, western regional sales manager for Webasto, suggests confirming the core is still intact before sending it in for remanufacturing.

“When you send these filters in, before you send them, take a wire, go down into the cells to make sure it’s not melted in the middle,” he says.

Webasto offers cold-start and idling solutions for the commercial vehicle market.

When it comes to setting a PM schedule for DPF cleaning, Griffith stresses it’s important to consider the operating environment of the fleet. But, as a general rule of thumb he has seen success with recommending a cleaning after 250,000 miles, when the vehicle will typically still be under warranty. During this PM, Griffith suggests more than just air to clean the filter, instead opting for a thermal, or even liquid, cleaning.

“With the newer filters, it’s a lot harder to get all of the ash out of those filters, so we’ve found where actual liquid cleaning [or thermal cleaning] is the way to go,” Griffith says.

“Of these cleaners, the aqueous types have proven far more effective than the ‘bake and blow’ method, at removing a higher percentage of ash from the DPF,” Ramirez confirms.

When completing a PM for the aftertreatment system, Griffith also suggests replacing the clamps and gaskets.

“If you think about it, you’ve got maybe 1,200 degrees F in the exhaust, and you have metal there,” Griffith says. “Metal expands and contracts with heat, so we recommend always replacing the clamps as well as the gaskets, just to make sure you get a good tight seal.”

Griffith’s final suggestion for preventive measures is to employ the use of a smoke machine when the system is disassembled for the PM “so you can verify that everything upstream is tight and you’re getting all the air volume and temperature you need to make sure that truck continues to regen for another 100,000 or 200,000 miles without having to touch the system again.”

An alternative to cleaning is always to replace the filter with a new unit. Replacement of the DPF may be the most cost-effective solution, depending on the overall cost of the aftertreatment program for the fleet.

Looking for signs and analyzing the filter itself can also prove useful to understanding issues on the vehicle.

“The more that these trucking companies can get educated at what the DPF is doing, what the markings are or the contamination that’s on the filter - then it gives them a little better fight to try to offset these issues,” Bratvold says.

Regardless of the method employed for handling

DPFs, an analysis is critical to understanding the full cost of an aftertreatment program, stresses Griffith.

For instance, if a fleet implements a filter cleaning program in-house, he suggests the company not look only at the cost of the cleaning process itself.

“If you can get a better cleaning process and you can reduce the number of filters you’re having to replace, you actually save money in the long run,” Griffith explains.



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"[Fleets may not] take into account the other factors around it, like what is the failure rate of the filter? If you get a really good cleaning process and you can bring the failure rate down, but the cost of cleaning goes up, you still actually win, because you're not replacing \$2,000 filters as often," he adds.

Effects of different duty cycles

Vehicle idle time plays a significant role in after-treatment system performance. In addition, duty cycle is an important consideration for the service frequency of aftertreatment systems.

"Depending upon how much idle time they have, whether the engine is consuming engine oil, the duty cycle — are they over the road or are they stop-and-go; the environment such as the ambient temperature — all those play a factor into how often the aftertreatment needs to be maintained," says Cummins' Lightner.

Idling is detrimental to extending the life of DPFs, says Webasto's Bratvold.

"Idling at a truck stop, or when they're out doing their normal job during the day just ... absolutely destroys a DPF. The DPF is so cold, all it is is like a garbage can collecting soot, and then it gets to a point there's too much soot and it can't overcome it," Bratvold explains.

This is because the engine aftertreatment system works most optimally at highway speeds, when a vehicle's engine gets hot enough to complete a regeneration cycle. Any extended idling means the vehicle's engine is not burning hot enough. This causes excessive soot to collect in the DPF, versus allowing the system to heat up to an optimal temperature to burn off the soot into ash. Technicians can complete forced regenerations, using a scan tool in the

shop to complete this service. But that takes the vehicle out of service as well.

Preventative measures to consider

Bratvold recommends, based on studies conducted at Webasto, that a coolant or engine heater can aid in reducing the service requirements on an aftertreatment system.

"We've proven that in some of the tests that we've done in the laboratory, where we've preheated an engine and started it up, and we measured the soot in that cold startup area," says Webasto's Bratvold. "Just by preheating the engine you can reduce that soot by 60-plus percent. If you can stop that cold, wet, dense soot from going into the DPF, until the DPF warms up to where it can start to regenerate, you've beaten half the battle right there." This can be done through an engine heating system, either specified at purchase or installed as an aftermarket option.

If you can preheat (the engine) every day, depending on your duty cycle, you can extend those intervals — you can probably cut out three to five cleanings per year, depending on what your duty cycle is," Bratvold says. "Every time that DPF gets full, if you do not deal with it then, right at that time, then you run the risk of a contaminant getting in there causing a catastrophic failure."

There are different options to heat up the engine, including a coolant heater and a plug-in block heater. The heater must be turned on about 45 minutes before the driver gets in the cab to start his or her route. This gives the system enough time to warm up before the vehicle is turned on.

For maintenance on the engine heater, Bratvold advises to turn it on at least 20 minutes per month,

Both driver and technician training is critical to ensure proper system care.

even in warmer months, to ensure continued operation. In addition, the fuel filter on the engine heater should be changed annually.

With that, driver education is critical to ensure system issues are addressed as quickly as possible.

"Operator error is probably the number-one failure of a DPF," Bratvold says. "A lot of these guys will drive down the road and the light will come on and they don't want to stop, so they'll just keep driving it until something goes wrong and they're forced to pull over."

"If a light comes on, you have to deal with it immediately," Bratvold adds. "You need to understand who is cleaning your filters and make sure they have the expertise to find issues and not just send you back the filter."

If a fleet employs a filter exchange program, Emission & Cooling Solutions' Griffith also suggests going through a single-source provider to service DPFs. This allows for complete data collection of all filters through one provider, versus going through multiple vendors.

"All that data comes into one place," Griffith says. "And it should be compiled and it should be presented as quarterly, monthly, yearly, however they want it."

It is also critical to ensure proper technician training when it comes to coding maintenance and service of the aftertreatment system.

"If you have a DPF failure and you're sending the filter out for cleaning and you're not getting that (filter) back, finding a way to code that as a failure is really the only way to do it - making it a data point, basically," Griffith says. "With the systems out there now, everybody runs their own proprietary kind of system, from what I understand, just making sure that people are recording it the correct way, so you can identify that part as a failed filter will lead to a better understanding of failure rates."

Takeaways and next steps

Emission & Cooling Solutions' Griffith recommends every fleet look at the total cost of aftertreatment - not just the price of the replacement filter, but the cost of cleaning, replacement programs and all aspects of the service.

"There are very few people who have a good grasp on exactly how much their aftertreatment is costing them," Griffith says. "We're using data analytics to really help people understand what their failure rate is, as well as identifying 'this truck has a higher failure rate than this truck.' In the future, some people will probably be using that when they spec their trucks." ■



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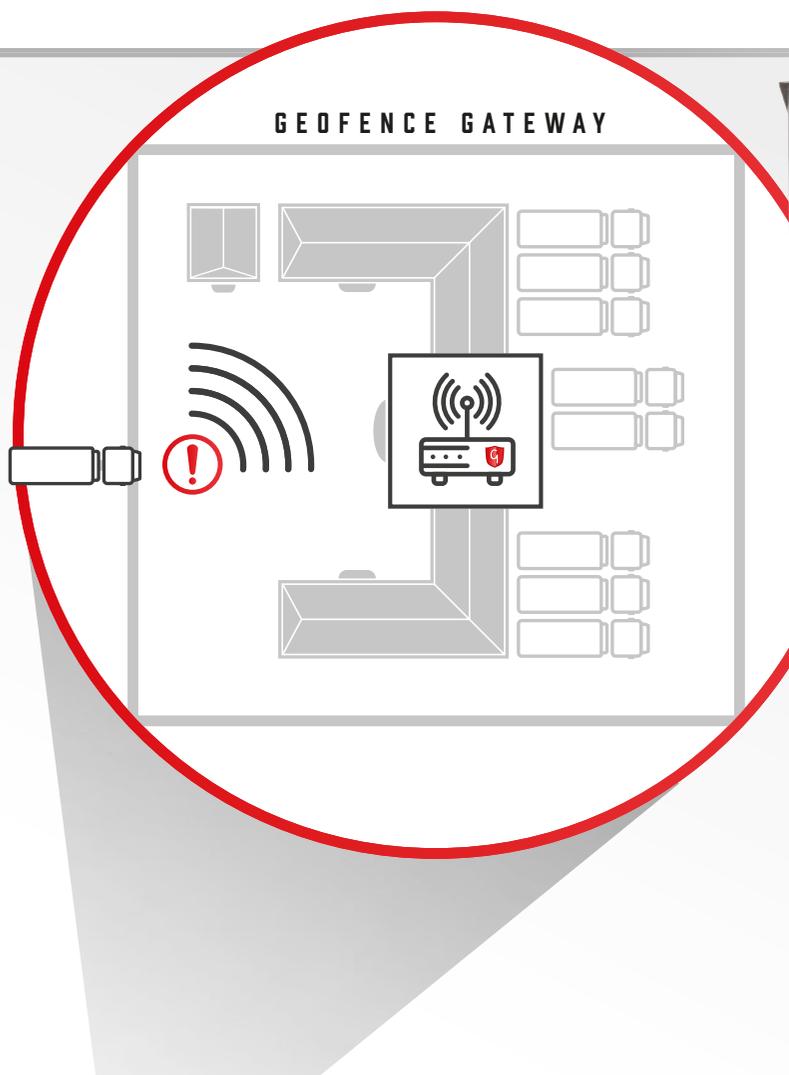
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Setting up a fleet maintenance facility

TO SERVICE NATURAL GAS VEHICLES

Safe and efficient servicing of this vehicle type requires maintenance facility modifications that address the properties and potential safety risks of natural gas.

By Gregg Wartgow, Contributing Editor

[FUELS & POWER SYSTEMS]

More fleets are realizing the financial and environmental benefits of operating natural gas vehicles (NGVs). As NGVs are incorporated into a fleet, it's just as important to realize that some potentially significant maintenance facility modifications likely need to take place.

"Many fleet maintenance facilities were built long before the advent of using natural gas as a vehicle fuel," says Leo Thomason, executive director of the Natural Gas Vehicle Institute (NGVi), which provides natural gas vehicle technical training and CNG fueling station technical consulting services. "Natural gas is lighter than air, so it rises quickly. No consideration was given to that when designing these facilities."

For liquid fuels like gasoline and diesel, the concern is over spills and leaks onto the floor. Thus, the ignition hazard area is the first 18" off



» As natural gas vehicles are incorporated into a fleet, maintenance facility modifications will need to take place.

Photo courtesy of Daimler



» A pass-through window presents a potential path of migration.

Photo courtesy of Gladstein, Neandross & Associates



» This gas-fired fan heater needs to be replaced or removed.

Photo courtesy of Gladstein, Neandross & Associates



» The most common form of facility ventilation is a roof-mounted upblast fan that vents into the atmosphere.

Photo courtesy of Gladstein, Neandross & Associates



» A ceiling-mounted combustable gas detection head.

Photo courtesy of Gladstein, Neandross & Associates

the floor. With natural gas – because it rises – the concern is the first 18” below the ceiling. In facilities that cannot achieve a certain level of continuous ventilation, the area within 18” of the ceiling must have explosion-proof electrical equipment.

“That becomes a huge problem for many existing maintenance facilities,” Thomason says.

Most of those problems can be overcome when fleets invite the assistance of natural gas experts.

“Fleets can look at this like they would any other facility upgrade,” says Ted Barnes, research and development director for the Gas Technology Institute (GTI). “You always want to get some kind of consultant or design firm involved. When you do that, this can be a fairly straightforward process.” GTI is a research, development and training organization addressing energy and environmental challenges to enable a secure, abundant and affordable energy future.

Start with a facility assessment

It is possible that no modifications will be necessary. It depends on the types of services being

performed in the facility. That is why a thorough facility assessment is the first step.

“If the fleet merely operates a *minor* repair facility, nothing new needs to be done in order to service NGVs,” says Daniel Gage, president of NGV America, which represents more than 200 companies, environmental groups and government organizations interested in the use of natural gas and biomethane as transportation fuels.

A minor repair facility is one that does not service a vehicle’s fuel system, nor does it provide services that require emptying of the fuel tank. Minor repair facilities engage in basic maintenance services such as lubrication, fluid changes, tire changes, parts replacement and engine tune-ups.

For fleets that engage in *major* repairs, some facility modifications will likely be necessary.

“The building envelope is the major thing we like to discuss first,” NGV’s Thomason says. “Are the trusses and ceiling cavity open and allowing for air movement, or is it all enclosed like you see

with these old pre-stressed concrete beam ceilings? That can create a major challenge.”

Fleets must also think about how their maintenance facility is structured. Are there offices that adjoin the maintenance facility? Does the partition separating the offices and the service area go all the way to the ceiling? Are there doors and windows? These are all potential avenues for escaped gas to travel through the facility, increasing the opportunities for ignition.

Once the facility assessment is completed, fleets should outline a modification plan and discuss it with the AHJ (authority having jurisdiction) to ensure compliance. That plan should include fuel types, maintenance activities to be performed, standard operating procedures and staff training. There are several fire safety codes, such as the International Code Council’s (ICC’s) International Fire Code or the National Fire Protection Association’s NFPA 30A, but not all are uniformly adopted by all local AHJs. That’s why

developing a relationship with the AHJ at the beginning of a modification project is such an important step.

"The AHJ is typically the local fire marshal," Thomason says. "In some instances, they are not familiar with the code for natural gas in a building. When this is the case, the fleet's natural gas consultant or building engineer can become an educator. I was once involved in a modification project at a large dealership in New Jersey. We gave a 30-minute presentation on codes and standards. They really appreciated it. That's much different than just putting a bunch of drawings and permits in front of them."

The U.S. Department of Energy's Office of Energy Efficiency & Renewable Energy has released a handbook outlining five elements that must be considered when developing a NGV maintenance facility design:

- ➔ Ventilation
- ➔ Containment (paths of migration)
- ➔ Space heaters
- ➔ Electrical wiring
- ➔ Methane detection systems

While all five areas need to be addressed, there are options to help fleets ensure safety and compliance while also containing costs. For example, it might be possible to section off

part of the facility for major vehicle repairs; only that section would be subject to any required modifications. Another approach could be to establish a certain number of bays as NGV bays, and then modify only the part of the facility where those bays are located.

Regardless of which approach the fleet adopts, the principle engineer for GTI, Tyler Manley, has a few words of advice.

"We like to say there are three main areas of focus when modifying a maintenance facility: detection, dilution and extraction," Manley says.

Let's look at how each component works to help ensure a safe environment for servicing NGVs.

Ventilation, dilution and containment

Ventilation must provide sufficient airflow to properly dilute and evacuate any escaped natural gas. Operators of traditional fleet facilities may need to reverse their thinking.

"In most cases with gas and diesel, fleets introduce air in the ceiling cavity and exit it out the doors," NGVi's Thomason says. "So the flow of air is from the top of the facility to the bottom. But since natural gas is lighter than air, that doesn't work. We have to bring air from the bottom of the facility and exhaust it out the top."

GTI's Manley says fleets can install fans either near the floor or near the ceiling, or in both locations if the extra cost isn't a deterrent.

"Most of the time we'll simply see fans up high," Manley says. "This is likely because they were located on the roof prior to the facility modifications, so there is no need to relocate them."

Keep in mind that anything within 18" from the ceiling may be rated as a Class 1, Division 2 electrical hazard zone. Thus, any electrical wiring and

CNG and LNG: different, but the same

Gas weight, odor and density set the two apart.

Today's natural gas vehicles are being powered by both compressed natural gas (CNG) and liquid natural gas (LNG). Leo Thomason of the Natural Gas Vehicle Institute (NGVi) says the important thing to understand is that CNG is lighter than air, and LNG is both lighter and heavier.

Here's why: At roughly minus 160 degrees F, LNG transitions from liquid to gas. Once in a gaseous state, the vapors are initially heavier than air. As it warms up, the gas becomes lighter than air.

"This is why fleets have to do all the same facility modifications for LNG that need to be done for CNG," Thomason says. "You also need all of the same modifications necessary for liquid fuels such as gas and diesel. But a fleet maintenance facility is typically set up for that so it's not an issue."

A big difference between CNG and LNG is that LNG is not odorized. Thus, with LNG, fleets are required to have a methane detection system installed in both the facility and on the vehicle. With CNG, a detection system is optional.

Why would a fleet opt for an LNG vehicle? Thomason says it's a storage strategy.

"A cubic foot of natural gas at atmospheric pressure is 14.7 psi," Thomason says. "If you compress that to 3,600 psi, you increase energy density 300 percent. If you take that same amount and liquify it, you increase energy density by 600 percent. So you can put twice as much natural gas on a vehicle when it's in a liquid state. When the fuel ultimately gets to an engine, though, it's all the same: natural gas at roughly 125 psi."

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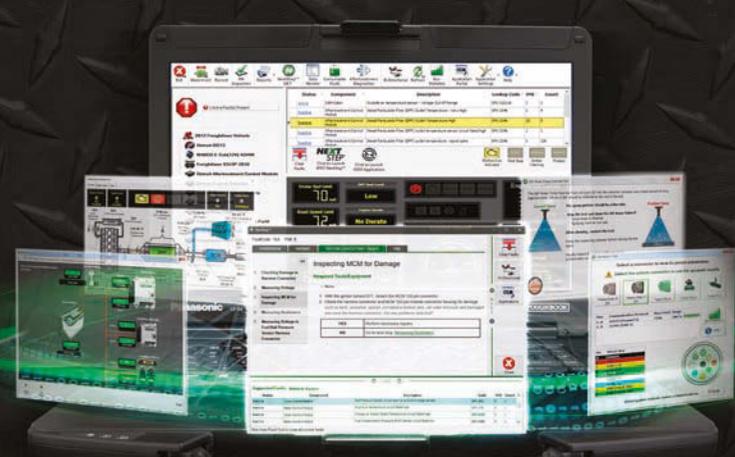


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appliances (i.e. fans) may need to be explosion-proof. It can be costly to relocate and/or upgrade these appliances. (More on this later under "Electrical, lighting and space heaters.")

Regardless of which ventilation strategy is employed, a certain number of "air changes per hour" is desired, typically four or five. That is reliant upon airflow of at least 1 cfm for every 12 cu. ft. of structural space. Some fleets will not be able to achieve that kind of continuous ventilation. But for those that can, some codes say that the 18" area from the ceiling is no longer an electrical hazard. A good natural gas consultant will help a fleet determine what is practical, compliant and cost-effective.

It's critically important to get the ventilation piece right. Proper ventilation is also necessary to dilute any released natural gas to a level that is no longer combustible, and then extract it. According to Manley, extraction means speeding up the migration path by bringing in fresh make-up air as low as possible, and then exhausting it as high up as possible.

"There are different sources of make-up air you can use," Manley says. "It's common to use bay doors with an electrical interlock alarm system. If a leak is detected, the doors automatically open up. We'll also often see fans and louvers near the floor to enhance airflow."

Another key consideration is how the fleet prevents any released gas from entering unprotected areas of the facility. NGVI's Thomason says fleets could put in two-hour firewalls from floor to ceiling to help contain gas to certain areas (i.e. NGV bays) that have proper ventilation. He has also seen instances where the AHJ approved a drift curtain. Additionally, fleets must look for openings such as windows between rooms, unsealed conduit pipes, structural members passing through walls and gaps between walls and ceiling panels.

Leak detection

Some fleets opt to have the facility's ventilation system tied to a leak detection system. This allows fleets to ensure safety while minimizing operating costs.

"The fleet has a choice of whether or not its ventilation

system runs all the time, is tied to the lighting system or is tied to a detection system," Thomason explains. "This decision is a purely economic one. For a fleet operating in a colder climate, for example, a lot of heated air could be allowed to escape if the ventilation is running non-stop all day long. We help fleets conduct a cost-benefit analysis on this."

Regardless, a leak detection system's job is twofold: alert personnel and disable potential

electrical ignition sources. GTI's Manley says it is common for fleets to install detection devices somewhere above the area in which a vehicle is parked, and occasionally in adjacent spaces.

Leak detection systems are mandatory for fleets running LNG (liquid natural gas) because LNG is odorless. For fleets running CNG (compressed natural gas), on the other hand, a detection system is considered optional



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Natural gas comes naturally to UPS

The fleet has implemented modifications to service natural gas vehicles at some maintenance facility locations, including ventilation and detection systems.

UPS first added compressed natural gas (CNG) to its fleet in 1989, later delving into liquid natural gas (LNG) in 2002.

The company has made significant investments in this alternative fuel over the past few years, most recently adding more than 700 CNG vehicles in June. The UPS fleet now operates well over 5,000 CNG and LNG vehicles including semi-tractors, terminal trucks and delivery vehicles. UPS also operates more than 50 natural gas fueling stations.

Rick Jordan, automotive senior director of maintenance and engineering for the UPS delivery fleet, says the company's maintenance facilities have had to undergo some modifications. The primary monetary investment has come by way of additional exhaust fans in many of the facilities. Additionally, the company decided to install methane detection systems in all facilities – even though detection systems are considered optional for facilities servicing just CNG.

“When you have a coast-to-coast operation like UPS, it’s important to think about all of the different codes and requirements that are out there,” Jordan says. “We developed a natural



» UPS has implemented modifications to service natural gas vehicles at some maintenance facility locations, including ventilation and detection systems.

Photo courtesy of UPS

gas program that encompasses all of the different codes we encounter because we like to standardize facilities and training as much as possible. Some jurisdictions require methane detection, and that has meant installing methane detection systems in all facilities.”

As Jordan points out, no two facilities are the same. Standardization is great, at least to the degree to which a fleet can achieve it. In some instances, UPS established stand-alone natural gas facilities. In other instances, only part of an existing facility was modified to work on natural gas.

“Depending on local codes, we typically had to build some additional walls to con-

tain the natural gas shop area from the rest of the operation,” Jordan says.

Once the modifications happen and the infrastructure is in place, Jordan says a fleet is ready to begin reaping the benefits of natural gas. Standard operating procedures, PPE and training cannot be neglected, though – especially in those instances where only a portion of an existing facility has been modified.

When fleets provide evacuation training for a stand-alone facility, only the people working in that facility need the training. But when fleets have a split facility, it’s important that everyone understands what is going on and receives the training.

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according to some codes. That said, some AHJs will require a detection system for facilities servicing only CNG vehicles.

Electrical, lighting and space heaters

This modification can become rather challenging for fleets. In many facilities, the area within 18" of the ceiling must have explosion-proof electrical equipment. This includes wiring, junction boxes, conduit, lighting, fans and other appliances. The exception is if the facility provides for continuous ventilation that allows for at least four air changes per hour (ACH).

If unable to achieve the four-ACH requirement, a fleet has two choices: relocate the electrical equipment below the 18", or replace it with Class 1, Division 2 rated equipment. Generally speaking, it can be less expensive to eliminate or relocate non-compliant electrical fixtures than to replace them with more costly explosion-proof units.

Space heating is another area of concern. Heaters with open flames or hot surfaces in excess of 750 degrees F cannot be present. Additionally, inside air cannot be used for a heater's combustion air. The supply air and exhaust flow from these heaters must be completely contained and directed from and to the outside of the facility.

Put the facility modification plan into motion

Once the fleet has devised a cost-effective plan that is accepted by the AHJ, it is ready to move forward. In some instances, it might make more sense to put up a new building. NGV's Thomason says that if a fleet's existing facility is already stretched too thin, putting up a smaller building solely for NGV service work could prove to be a more cost-effective option.

"The good thing is that if the fleet ever wants to also work on gas or diesel vehicles in that new building, it's no problem," Thomason says.

Fleets may also consider servicing NGVs outside.

Thomason says there are tent-like structures that are cost-effective. Many are designed in such a way that ceiling ventilation is inherently provided.

"This is definitely an option for fleets in certain environments where excessive heat and cold are not an issue so they don't have to worry about heating and cooling systems," Thomason says. "I actually had a client in Oakland, California, that went this route."

However a fleet goes about servicing NGVs, train-

ing and standard operating procedures are going to be key. There are several organizations and online resources to help fleets learn how to incorporate natural gas into their operations. A few notable examples are ngvamerica.org/fuel, ngvi.com and altnaturalgas.org/natural-gas. ▀

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Another approach to problem-solving

Decision-making used to have a more simplified and straightforward process.



By Joel Levitt

PRESIDENT, SPRINGFIELD RESOURCES

Springfield Resources (maintenancetraining.com) is a management consulting firm that services a variety of clients on a wide range of maintenance issues. Levitt is the president of the company, and has trained more than 17,000 maintenance leaders from more than 3,000 organizations in 24 countries. He is also the creator of Laser-Focused Training, a flexible training program that provides specific targeted training on your schedule, online to one to 250 people in maintenance management, asset management and reliability.

We are living in a world dominated by VUCA.

What is VUCA? It stands for: Volatility, Uncertainty, Complexity and Ambiguity. It's a concept that helps define increasingly complex problems, and helps to assist with determining a solution.

I learned about this concept when I attended an educational session run by Barbara Taylor, an executive coach. The idea of VUCA originated at the U.S. Army War College to assess the world after the Cold War. While employed by the U.S. military for decades, only within the

» VUCA is a concept that helps define increasingly complex problems, and helps to assist with determining a solution.

Photo from iStock

Building muscle in solving these higher VUCA problems involves thinking in terms of A and B rather than A or B.

last two decades has it become a leadership strategy concept for businesses.

Overview of VUCA

The mix of the types of problems we face in the workplace has shifted, so the strategy to get to the solution also has to change.

Taylor defined a VUCA world as being one where these descriptors dominate:

- ☞ **Volatility:** Fast change happens without a clear, predictable trend or pattern. The duration of these trends or patterns is unknown, and the outcome is unexpected and unstable. Volatility is understandable, and you can gain knowledge from it, but it takes work.
- ☞ **Uncertainty:** This refers to frequently disruptive changes. Additionally, the past is not a great predictor of the future. However, the basic cause and effect is known. Change is possible but not a given.
- ☞ **Complexity:** The situation has many interconnected parts and variables. There are many moving parts, and the volume can be overwhelming to process.
- ☞ **Ambiguity:** There is little clarity about what is real or true. The meaning and outcome of casual relationships are unclear. No precedent has been set, and we may be faced with "unknown unknowns."

We are in a time of increasing VUCA. There have always been problems of all types within the commercial vehicle industry. For example, look back to discussions on diesel costs and the impact on fleet operating costs. This issue can be viewed as a VUCA problem.

Simpler times

Before the increase in VUCA, most issues could be viewed as puzzles.

In a puzzle, there is one best solution and the trick is to arrange the pieces or facts in the right order to solve the problem. Problems like fleet size, inventory levels and skills needed, for example, fit into this problem-solution model. Normal tools of leadership apply to helping resolve the problem, like project



management, resource allocation or performance management. These are thought of as linear processes with a solution. The process will apply to all of your sites.

Puzzles exist in mainly a stable environment. To have a puzzle, the desired outcome cannot change and the pieces can't change, or the puzzle won't work.

To address these complex VUCA problems, it is important to:

- ➔ See it: Become aware that you are dealing with a dilemma
- ➔ Map it: Articulate the polarities of the dilemma, e.g. the need for control AND the need for empowerment/autonomy/freedom to act
- ➔ Finally, shift the question we ask to include both:

- How do we have confidence AND humility?
- How can we improve controls by improving empowerment?

How are the decisions you make for the business changing? Are you in a high VUCA situation? If so, there will be more of this. It is important to acknowledge that it exists, and implement strategies to address these problems. ■

Addressing more complex problems

As VUCA increases, using puzzle-solving techniques becomes more irrelevant.

The new problems we are facing are not problems at all in the conventional sense. They are more like paradoxes or dilemmas. Take the problem of employee retention. On one hand, it is known an empowered workforce is more stable and more productive. On the other hand, companies are requiring more and better control. Rather than a traditional puzzle, the solution requires the acceptance of both of these issues.

Building muscle in solving these higher VUCA problems involves thinking in terms of A *and* B rather than A *or* B. Here are some dilemmas we face every day. The solution is to accept both outcomes:

- ➔ Frankness AND diplomacy
- ➔ Responsibility AND freedom
- ➔ Guidance AND tolerance
- ➔ Confidence AND humility
- ➔ Critical analysis AND encouragement
- ➔ Control AND empowerment
- ➔ Grounded AND visionary
- ➔ Structure AND flexibility
- ➔ Logic AND creativity
- ➔ Individual AND work group
- ➔ Planning AND implementation
- ➔ Decisiveness AND mindfulness

Most people are great linear thinkers and can take action to solve a puzzle-type problem. But, many become unmoored when the problems keep morphing into these complex, no-win, high-volatility situations.

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» Fleets running in extremely cold conditions might decide to push the glycol levels to the upper limits for optimum freeze point protection.

Photo courtesy of Prestone Products Corp.

Find the right balance

It is essential to stick to a recommended maintenance schedule and practices as winter weather puts strains on the vehicle's engine. The functions of AF/C are far more complex than just freeze and overheating protection. The latest technologies in today's AF/C provide a layered approach to controlling engine temperatures, as well as protecting engine components from premature damage and corrosion.

If the cooling system is unable to satisfy the essential requirements put on it by the engine, the vehicle's horsepower, fuel efficiency, emissions and overall durability will be compromised.

Selecting the highest quality AF/C products and replenishing at recommended intervals will ensure operating efficiency and optimal performance. Controlling as many variables as possible and keeping trucks on the road will directly impact the bottom line of any operation.

Tips for cold weather coolant maintenance in heavy duty vehicles

Selecting the right antifreeze/coolant ensures efficient operation and optimal performance of the vehicle's engine.

As winter descends upon the U.S. with brutal temperatures fast approaching, the importance of preparing a heavy duty engine becomes critical to vehicle uptime. This is espe-

cially important for cooling system maintenance. When it comes to freezing – and also summer boilover – the mixture of water and antifreeze/coolant (AF/C) needs to be just right.

Proactively testing engine coolant is essential to making the right decisions for maintaining the correct levels of coolant concentrations.

The challenge

While the threat of winter freezing may appear, on the surface, to be the primary concern, corrosion mitigation is also a primary function of coolant. Testing the coolant concentration (mixture of glycol, water and inhibitors) is an important part of winter engine management.

Water and a water-glycol mixture alone are naturally corrosive. Coolant manufacturers add chemicals, known as corrosion inhibitors, to the glycol/water mixture in order to prevent the cooling system components from corroding.

The very best coolants will not only protect a heavy duty engine from freezing



By Collin Dilley

VP TECHNOLOGY, PRESTONE PRODUCTS CORPORATION

Prestone (prestone.com) manufactures and markets antifreeze/coolant, brake and power steering fluid, windshield washer fluid and other leading vehicle maintenance products. Dilley was appointed the vice president of technology at Prestone Products Corporation in 2014. He has been directly responsible for developing and launching several proprietary Prestone products, including Prestone's Cor-Guard corrosion inhibitor technology in the company's coolant. He holds a Ph.D. in Applied Management and Decision Science from Walden University.

up in cold temperatures, they also actively fight metal corrosion within the engine. Corrosion, and rust in particular, can degrade the effectiveness of an AF/C system, negatively impacting performance and the long-term health of the engine. Given the multitude of metals making up any engine, it is important to understand the need for corrosion protection.

With the seemingly innocuous decision to merely add water to a cooling system, a heavy duty cooling system can incur corrosion from this unintended dilution, as well as a loss of protection, leading to an increased incidence of liner pitting.

While most coolants will protect a heavy duty engine from freezing up in cold temperatures, they also need to actively fight metal corrosion within the engine cooling system. Corrosion can degrade the effectiveness of a cooling system by generating deposits in heat exchangers and negatively impacting the performance of the radiator to remove heat from the system.

Test coolant levels

Testing coolant levels is essential for protecting a heavy duty engine. If the glycol concentration is too rich or too low, freezing and boilover protection becomes a problem, as can changes in the level of inhibitors necessary to protect the essential engine components.

Fleets running in extreme cold conditions might decide to push the glycol levels to the upper limits (a maximum of 70 percent is recommended) for optimum freeze point protection. Extreme care at these concentrate levels must be exhibited when warm temperatures approach. The coolant concentrate needs to be rebalanced to recommended concentrations of 50 percent to optimize the heat transfer properties of the coolant (the ability to keep the vehicle from overheating).

Excessive levels of glycol and relatively low levels of water create a pool heat transfer environment that will encourage higher

underhood temperatures, overall cooling system fatigue and potential engine overheating and failure, while insufficient glycol percentages can also compromise corrosion additive effectiveness.

Proactively testing engine coolant is essential to making the right decisions for maintaining the correct levels of coolant

concentrations. There are a number of testing options that offer the ability to test a wide range of important coolant variables from basic glycol concentration, to far more extensive methods that measure conditions of the fluid and the ability of the coolant to protect the engine from corrosion by measuring the level of inhibitors. ■



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What did we learn from this year's TMC SuperTech?

A reflection of the last 14 years as the chair for the technician skills competition.

The Technology & Maintenance Council's TMC SuperTech 2018 Technician Skills Competition is now in the books. What did we learn from this event?

First, all of the first-place winners in the four competitions of this year's TMC SuperTech – which includes the traditional heavy duty diesel technician track, the TMC FutureTech student track, the trailer track and the light/medium duty technician track (new this year) – were all first-time winners.

All of the individual competitions had a combination of specific skills that these technicians perform on a regular basis, as well as a series of skills that, at times, we may not place near the emphasis we should.

I refer to these skills that aren't necessarily used on a regular basis as the "assumed skills." Assumed skills include some of the following

categories: fasteners, precision measuring, torque and reading wiring diagrams. These skills are not normally tested, but are very important to the technician's ability to perform specific tests and proper procedures in the diagnosis and repair of vehicles.

Electrical systems skills

In all of our competitions, TMC has had multiple stations that incorporate electrical systems, including stations such as electrical meters, trailer lighting, engine electrical, aftertreatment, HVAC and electrical circuits. By having different stations requiring the participants to demonstrate their electrical and/or use of meter skills, TMC is able to better understand any potential trends or areas the competing technicians may be proficient or need improvement in.

This year we had a station testing for skills with electrical meters measuring current flow (amperage) and, let's just say, we blew a lot of fuses. Some technicians might measure voltage and resistance/continuity, but current flow is also important to completely understanding a circuit's ability to flow electricity through a wire and ensure the wire and circuit can handle the amperage.

Engine aftertreatment

Aftertreatment is the topic of many conversations regarding vehicle maintenance these

» The TMC SuperTech Technician Skills Competition has assisted contestants, their employers and the industry with an increased knowledge on how to diagnose and repair vehicles.

Photo courtesy of TMC

days. With that, TMC has ramped up station involvement in this area. Everyone except for trailer contestants completed an aftertreatment station. We expanded the aftertreatment station this year to FutureTech contestants, as well as the light/medium duty competition. We plan to continue to increase activities related to aftertreatment next year.

Expect aftertreatment to expand to multiple stations next year, like we have done with electrical. By expanding the number of stations that incorporate aftertreatment, or other areas of concern to the industry, we are able to gather additional data and have a better understanding of possible gaps in training and the actual ability of technicians to diagnose and repair these systems.

In addition, on the gasoline side with the light/medium duty track, there was a station called "EVAP" (evaporative emission systems). Participants were given a vehicle with an illuminated "Check Engine" light and were required to diagnose and find the cause of why the light was on.

Demonstration areas

This year we had two demonstration areas. These stations were designed to gather the technician's knowledge and understanding, or concerns and processes, in either new or emerging technology. These stations are not scored as part of the participants' overall score.

For instance, for the second year, TMC SuperTech had a cybersecurity station and continues to see an increase in the role that



» This skills station, at TMC SuperTech 2018, tested technicians on their ability to use digital multimeters to measure current flow.

E. Schueller



By George Arrants
TRAINING CONSULTANT, K&D TECHNICAL INNOVATIONS

George Arrants is the training consultant for K&D Technical Innovations. As an automotive education consultant specializing in National Automotive Technicians Education Foundation (NATEF)/ASE accreditation, Arrants works with instructors and administrators to develop partnerships with local business and industry through program advisory committees. He chairs the Technology and Maintenance Council's TMC SuperTech – the National Technician Skills Competition – and the TMC FutureTech – the National Student Technician Competition. His entire career has been in the automotive service and education industries.



plays in the companies and shops. The scenario presented to participants involved a truck which stopped running and was towed into the company, but no issues were found with the vehicle. The company was then contacted to wire money to an off-shore account or the truck would remain non-functional. What would they do next?

The competition also had a “Right to Know” station designed to help heavy duty truck technicians understand and utilize a NASTF (National Automotive Service Task Force) Service Information Request. This process was created to give technicians a venue to share information on gaps they have found in service information or scan tool availability.

Over time and as the need for skills and procedures in these areas increases, these stations may become part of the competition.

Students and professionals

The TMCFutureTech competition again this year incorporated skill stations that are important to the industry and to employers when it comes to entry-level skills. As part of this competition, students are able to showcase their skills to the TMC membership in attendance. The student contestants competed in multiple stations that were the same stations as the professionals participating in the traditional TMC SuperTech competition.

I believe it’s important that we evaluate these student competitors in these specific areas the same as we do the professionals. This provides both the student and the school they are attending with an increased understanding of the skills our industry requires for an entry-level tech. The educational institution will then hopefully incorporate these skills into their program training.

Conclusion

This year marks 14 years of the TMC SuperTech technician skills competition. The competition has assisted the contestants, their employers and our industry with an increased knowledge on how to diagnose and repair vehicles. These folks that repair vehicles and

compete in TMC SuperTech are truly amazing individuals. They continue to show what true professionals they are and how they do their job. My hat’s off to every one of them.

This was my last year to chair TMC SuperTech, and these have been the most rewarding 14 years of my professional life. I want to say “thank you” to all the contestants over the years, their employers for supporting them,

the volunteers – including station chairs, judges, suppliers, the Professional Technician Development Committee (PTDC) and TMC. Most of all, thank you to TMC’s Executive Director, Robert Braswell, and his team for everything they do. It has been an honor and privilege to chair this awesome group of folks in an industry that 14 years ago I knew little about. Today, I am glad to be one of them. ▀

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» Manual regenerations must be completed in the shop using a qualified scan tool. The Autel MaxiSYS 906CV tablet can autoscan all systems and also view live data to provide details to the technician on how the engine is functioning.

Photo courtesy of Autel



» Technicians must plug the diagnostic tool into the vehicle's OBD port. A static forced regeneration can take up to an hour.

Photo from iStock

Critical aspects of servicing the diesel particulate filter

With the advent of more stringent emissions regulations on heavy duty diesel engines, it is now more critical than ever that heavy duty exhaust systems and their components be properly serviced.

When heavy duty vehicle technicians discuss maintenance, the conversation usually includes oil changes, brake checks, inspecting for coolant leaks and tire wear.

In addition, the diesel particulate filter (DPF) is also high on the list of vehicle components no technician should ever neglect. Failure to maintain the DPF and its supportive system not only will result in anemic acceleration and poor fuel performance,

but may result in damage to the filter itself, the exhaust system or engine.

Development of the DPF

The development of the DPF and its installation on all model year 2007 and newer heavy duty diesel engine vehicles made in the U.S., was prompted by the U.S. Environmental

Protection Agency (EPA) Diesel Emissions Reduction Act. This initiative was implemented to reduce particulate matter released into the atmosphere by diesel fuel combustion, which is believed to cause asthma and other respiratory ailments, including lung cancer.

The DPF is usually made of ceramic composites and is installed as part of the exhaust system. Its layered walls trap soot and ash, the byproducts of fuel and oil combustion, preventing these residual toxins from escaping into the air.

It is not permissible to disable the DPF system. Not only will the system no longer operate as needed to remove particulate matter from the exhaust of the vehicle, but fleets may face penalties and fines if they do not adhere to U.S. EPA regulations.

Understanding the DPF

Instead of ignoring or dismantling the DPF, it's important for fleets to take time to understand the system. This includes the best way to maintain it. Over time and use, soot builds up in the filter, constricting air flow and increasing pressure before the filter. Sensors, located before and after the filter, monitor the level of soot within the filter by measuring air pressure. When significant pressure is detected, the powertrain control module (PCM) initiates a DPF regeneration.

DPF regeneration, sometimes referred to as regen, is designed to automatically reduce the buildup of soot in the filter, and therefore reduce the pressure in the filter. Regeneration should not be confused with cleaning. DPF regeneration is actually the burning of the larger particulate matter into smaller ash.

Separately, cleaning a DPF involves removing the filter and bringing it to a shop that uses a thermal heating or forced air process to remove the caked soot. Such cleanings are said to restore the filter to close to 90 percent of manufacturer's recommended back pressure. Instead of cleaning the DPF, fleets may also opt to replace the DPF.

Some fleets have started to include having the DPF cleaned every 120,000 miles as part of the per-vehicle maintenance plan.

There are three types of DPF regeneration: passive, active and forced.



By Michael Flink
AUTEL, INSTRUCTOR, HEAVY DUTY VEHICLE DIAGNOSTICS

Autel is a manufacturer and supplier of professional diagnostic tools, equipment and accessories. Flink has spent close to 30 years in the passenger and heavy duty vehicle diagnostics and repair industries. His experience, teaching skills and education make him a sought-after instructor in the continually evolving vehicle diagnostics market.

Types of regeneration

There are three types of DPF regeneration: passive, active and forced. A passive regeneration uses a diesel oxidation catalyst (DOC) alone that acts to heat air before it reaches the filter. The vehicle must be driven at a significant speed for a period of 30 to 50 minutes to allow the exhaust temperature to rise high enough to adequately burn the soot.

Some fleets may never generate enough heat automatically, due to being driven locally with a series of stops and starts. An alternative type of regeneration was devised called active regeneration to handle these situations. An active regeneration injects extra fuel or diesel exhaust fluid to increase the temperature high enough to incinerate the trapped soot within the filter.

Neither passive nor active regenerations require the vehicle operator to take active measures. However, when both previous processes fail and a REGEN malfunction light displays yellow on the driver's dashboard, it's time to take real action. Fleets should not wait for the light to flash red and risk damaging the engine. It is important to note that regeneration will not be initiated if any engine codes are detected. To this point, it's vital to address engine and exhaust system failures upstream from the DPF as these failures may have a critical effect on the DPF and the frequency and success of any type of DPF regeneration.

The third type of regeneration is referred to as manual regeneration, sometimes called a forced regeneration. This process must be completed in the shop by a technician, using a scan tool with manual regen capabilities.

Just like other vehicle diagnostics using a scan tool, technicians must plug the diagnostic tool into the vehicle's OBD port. Depending on the scan tool used, condition of the filter and the vehicle type, a static forced regeneration can take up to an hour. Some vehicles require an in-motion forced regeneration whereby the vehicle would need to be driven at specific a speed and distance while the diagnostic tool is connected to the OBD port. An additional technician should be present in the vehicle while in operation to

observe displayed process and provide feedback information from the diagnostic device.

A scan tool that can automatically scan all systems and view live data can provide information on how the engine is functioning, in addition to the condition of the DPF. Some scan tools may also have the ability to run a forced regeneration when passive and active regenerations have failed. When technicians are completing

this service on the vehicle, they should also complete a thorough inspection of upstream systems such as the injectors, exhaust system and coolant system as well.

The DPF system is just one of the many systems so vital to optimum vehicle operation. Giving it proper attention and care is equally as vital to ensuring a fleet's vehicles stay on the road and out of the shop. ▀



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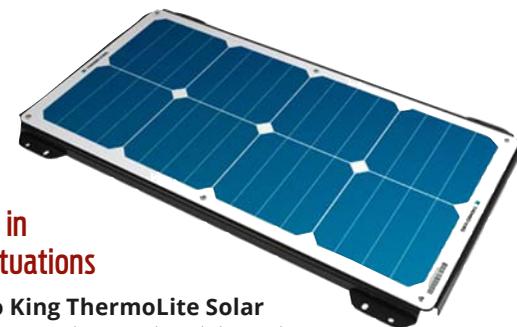
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» 10" latex foam mattress constructed with a combination core

The **Lippert Components Somnum Sleeper Series Mattresses** are designed to provide comfort and support for commercial truck drivers. The Somnum Discovery mattress is a 10" latex foam mattress constructed with a combination core. It pairs a thick polymer, spring base core, with a natural latex upper core. The Indura Spring polymer base provides all the support and adds a durable, breathable cushioning solution. The 3" natural latex upper core delivers elite cushioning for pressure points such as hips and shoulders, according to the company. The mattress's Euro-top construction comes complete with somnum's premium soft knit cover, and an extra inch of quilted foam sewn into the cover for added luxury. This mattress is available in multiple sizes.

➔ For more information visit VehicleServicePros.com/21021938



» Provides emissions-free truck cooling

The **ComfortPro Electric Auxiliary Power Unit (APU)** from **Carrier Transicold** provides quiet, emissions-free truck cab cooling while delivering a long run-time. This APU is powered by four Group 31 AGM batteries that are charged by the truck's alternator. The APU provides 7,500 Btu/h of air conditioning for up to 11 hours. With a simple design and only a few moving parts, there is no engine-related maintenance such as oil, fuel or air filter changes, according to the company. This unit is easy to install and can help reduce truck engine idling, helping drivers comply with local and regional anti-idling regulations while saving fuel and reducing engine wear.

➔ For more information visit VehicleServicePros.com/21026710

» For refueling on the work site

The **Western Global ABBI Blue** is a mobile refueling unit that provides improved convenience for customers who need to refuel various pieces of equipment at their work sites. The primary tank holds 395-gal of fuel, while a separate 42-gal compartment holds DEF. Designed with a lower center of gravity and mounted to a DOT-approved trailer with electric brakes, the ABBI Blue is easy to transport. This tank is double-walled and has a lockable equipment cabinet for security.

➔ For more information visit VehicleServicePros.com/21026800



» For improved protection in extreme conditions

The **Shell Lubricants Shell Rotella Gas Truck Full Synthetic Engine Oil** is designed to provide extreme protection for towing and hauling gasoline-powered pickup trucks and SUVs. The oil offers the protection these engines need in three viscosity grades: 0W-20, 5W-20 and 5W-30. This oil is formulated to provide unsurpassed wear protection in extreme conditions, including heavy hauling, towing, extreme temperatures and off-road. The synthetic base oil delivers added oxidation stability, improved volatility and low-temperature properties. The oil will be available in one quart, five quart and Ecobox sizes.

➔ For more information visit VehicleServicePros.com/21031839

» Ten-stage acceleration-sensitive damping technology

The **Tenneco Monroe Magnum Loaded Strut Assemblies** for multi-purpose half-ton pickup trucks feature high quality components for improved ride characteristics and durability under a wide range of loads. The premium, gas-charged Monroe Magnum strut features 10-stage, acceleration-sensitive damping technology; nitro-carburized piston rod and PTFE-coated bearing; OE-style upper strut mount and bearing; enhanced-design dust boot; and jounce bumper. Each unit is covered by a limited lifetime warranty.

➔ For more information visit VehicleServicePros.com/21031185



» Drop-in, bolt-on replacement with OE fit

The **LoadHandler Power Products L545 Gear Reduction Starters** are designed to fit 3.9L to 5.9L Cummins diesel engines. These starters offer up to 2.5 kW output in 12V systems. This starter is a drop-in, bolt-on replacement with the same appearance, fit and function as the OE design. The starter features a heat-treated shaft for improved durability and service life, and the unit includes a one-year, parts-only warranty.

➔ For more information visit VehicleServicePros.com/21026803



» Offers flexible seal with no shrinkage or expansion

The **Lord Corporation Fusor 231/234 Sound Dampening Material** is designed to reduce noise, vibration and harshness on vehicle metal panels when placed between any outer skin and inner structure where sound dampening is required. Fusor 231/234 is a two-component urethane that offers excellent adhesion to metal, e-coat and existing NVH materials, enabling a flexible seal with no shrinkage or expansion. It can be applied to vertical or overhead surfaces with no sag or drip.

For more information visit VehicleServicePros.com/21026794



» Technology helps seal punctures

The **Goodyear SSD Wide Base Drive Tire** incorporates fuel-saving compounds with advanced tire constructions and tread designs for low rolling resistance, the company says. This tire contains DuraSeal technology that helps seal punctures of up to 1/4" in diameter in the repairable area of the tires' tread. The SSD features wide grooves with stone ejectors that help resist stone drilling to improve casing durability. Tredlock Technology with interlocking microgrooves helps stabilize the tire's tread for high mileage, and an open shoulder design offers all-season traction. This tire is available in size 445/50R22.5.

For more information visit VehicleServicePros.com/21026120



» Curved end optics support off-angle performance

Code 3's Mega Thin Stik Combination Warning and Emergency Light offers a waterproof, compact design that allows for a variety of interior or exterior applications, such as the upper and rear deck or behind the grille. This light offers warning lights, ArrowStik light and extra reverse and scene lighting. The light features curved end optics for improved off-angle performance, low-profile aluminum housing and a heat-resistant polycarbonate lens.

For more information visit VehicleServicePros.com/21026438

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» Provide cooling and protection against extreme heat

The **DEI Flexible Heat Shields** are available in three finishes and provide cooling and protection against extreme heat. Excessive heat can damage brake lines, transmissions, hoses and electrical wiring, causing expensive repairs. These heat shields are rated to handle heat up to 1,350 degrees F, and are ideal for any application where heat protection is needed. Each shield is constructed with two durable materials formed into a dual-layer design. The outer layer is a heat-treated glass fiber with molten aluminum that is formed into a tight weave for durability and strength. The inside material is a specially treated, high temperature resistant fabric that can withstand extreme heat. All heat shields feature a pipe stand-off formed with two 3.5" clamps. The clamp-on, no-drill design makes installation easy.

➔ For more information visit VehicleServicePros.com/21026161



» Beads distribute to point of imbalance

The **Ken-Tool Balancing Beads for Trucks** are designed to balance not only the tire and wheel, but the complete axle end and all the moving components of the wheel assembly. The Balancing Beads are tiny glass beads with a proprietary coating that repels moisture, prevents clumping and features a unique memory technology to stabilize the beads inside of the tire. The beads use the rotating tire's centrifugal force to distribute beads to the critical point opposite the imbalance, and respond to changes in speed and direction to maintain rotating balance. The beads are available in 1 oz. to 16 oz. drop-in plastic bags, with the number of bags used per tire determined by tire size. They can be sold in individual bags, or in case lots.

➔ For more information visit VehicleServicePros.com/21026992



» Truck WallSlide work truck storage system

The **CargoGlide Truck WallSlide** is a work truck storage system designed to maximize the unused space usually found in the back of a truck. The Truck WallSlide has a steel framework which is mounted to a truck bed with manual or motorized walls. The product allows tools and materials to slide out of the truck bed directly into the users arms at chest height. This system eliminates the need to bend over, twist and reach for materials. The overhead ceiling slide rail allows ladder storage and utilization of the top center space.

➔ For more information visit VehicleServicePros.com/21029074

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» Cut- and chip-resistant compound

The **Continental 16" Conti LAR3 Tire** is an all-position tire designed for the high scrub conditions faced by regional delivery drivers, and can withstand the rigors of regional routes and speeds of more than 90 mph under max load, the company says. The tire's all-steel radial casing is optimized for retreadability. Other notable features include cut- and chip-resistant compounds, optimal handling with a pattern engineered to minimize stone retention and maximize wet traction and fuel efficiency. The 10-ply radial helps improve load carry capacity and puncture resistance. This tire is available in three sizes: LT225/75R16, LT235/85R16 and LT245/75R16.

➔ For more information visit VehicleServicePros.com/21026970

Congratulations TO OUR 2018 CONTEST WINNERS

More than \$42,000 in prizes won

The list of winners is as follows:

ATEQ VT56 TPMS Tool Kit with OBDII
 Joe Denny, Lexington, SC

Bartec Master Bundle—Own the Wheel Well
 John Coschignano, Oyster Bay, NY

Beta Tools C58P Steel Wall Cabinet
 Tina Redman, Oakhurst, CA

Bosch Diagnostics ADS 625 Professional Diagnostic Scan Tool
 Dawon Sanner, Fairfield, CT

Bullet Proof Diesel Gift Certificate
 Gary Rainwater, Springfield, MO

Coast Automotive LED Lights and Knives Prize Pack
 Jason Reinke, Columbus, NE

Homak Manufacturing 72" RS Pro Combo Toolbox
 Luke Huotari, Iron Mountain, MI

KNIPEX Tools 17-pc Tool Set Prize Pack
 Dennis Held, Champaign, IL

KT Pro 8-pc Tool Set Prize Pack
 James Hoeft, Elgin, MN

Flexzilla Air Compressor with Silencer Prize Pack
 Tom Hamscher, Pittsburgh, PA

Lumax RoboLuber-LX-1182
 Peter Bu, Drexel Hill, PA

CAS G-Scan 2 Kit
 Pete Anacabe, Castroville, CA

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TOOLS & EQUIPMENT

A roundup of the latest tool and equipment offerings.



» Designed for low-ceiling garages

The **BendPak GrandPrix Two-Post Lift** is designed for low-ceiling garages. With an overall width of just over 10', this lift saves space and fits where other lifts don't, the company says. Users can choose from three models, so garages with ceilings as low as 9' can comfortably hold the model that's right for them. The GrandPrix has full ALI certification and offers a five-year warranty.

➔ For more information visit VehicleServicePros.com/21030728

» Swivel handle rotates 180 degrees

The **Cloro Automotive Light-N-Carry 800 lm COB LED Work Light**, No. LNC1841, is designed to be reliable, tough and compact. This light provides a maximum output of 800 lm from its high worklight setting and features both high and low settings. Its focus beam provides 60 lm to illuminate a specific location, and the swivel handle rotates 180 degrees and features magnet mounting to allow ideal positioning in the work area. The light has up to a 3.5-hour runtime on high and is IP54-rated dust/water ingress protection. The light includes a wall charger with braided cable, repair service coupon for one-time, fixed-free repair after the warranty period and a one-year limited warranty.



➔ For more information visit VehicleServicePros.com/21021048

» Designed to make specific removal applications easier

The **Mayhew Tools 4-pc Specialty Hammer Set**, No. 32024, includes a concave hammer, smoothing hammer, peen hammer and U-joint hammer. Each hammer is designed for specific removal applications: The smoothing hammer is used to remove details such as creases or curves on surfaces; the concave hammer rides on the pin when starting, pushing bolts out of corroded locations; the u-joint hammer is for removing u-joints or straightening a tie rod; and the peen hammer is used to shape or work metal. The tools are packaged in a self-contained, reusable storage tray that fits most toolboxes.

➔ For more information visit VehicleServicePros.com/21021072



» Records visual traces of electrical issues

The **Power Probe Tek Maestro** is a diagnostic tool that is able to communicate with the Power Probe Tek App. Working in conjunction with the app, this tool allows users to data-log either screenshots or record visual traces of their customer's electrical issues. This tool has the ability to display oscilloscope-type measurements. In addition to the multimeter functions, guided diagnostics, testing of fuel-injectors and the ability to apply battery-supplied power and ground, the Maestro is compatible to connect with the majority of diagnostic scan tools on the market today, the company says.

➔ For more information visit VehicleServicePros.com/21026780



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» **Lightweight design weighs 2.5 lbs**

The **Weego 66 Jump Starting Power Pack** offers a 10 percent increase of true cranking amps compared to the company's previous version, to reach 660 amps. This jump starter offers a lightweight design of 2.5 lbs, and delivers a high powered jump starting charge that works on trucks, tractors, cars, boats and light duty equipment. The company's patented Smarty Clamps firmly contact hard-to-reach terminals found in many commercial vehicle battery compartments. AutoBoost technology ensures dead batteries as low as 1/2V can be safely jumped without a built-in override button. This starter can charge personal electronics with 5V USB and 19V outputs, powers 12V portable accessories and provides ultra-bright light with a 600 lm dual LED flashlight. This product is backed by an 18-month warranty.

➔ For more information visit VehicleServicePros.com/21026989



» **Designed for minimal shop footprint**

The **John Bean Heavy Duty Tire Changer**, No. T8010TR, can service truck wheels up to 24.5" and tires as large as 47". This tire changer is designed to take up a minimum amount of shop floor space. Notable features include: integrated control panel that conveniently moves into any position, allowing one tech to operate the tire changer; unique dual roller is designed to service tubeless assemblies; suitable for trucks running cosmetically sensitive alloy wheels, including reverse drop center rims. This tire changer is designed for quick installation.

➔ For more information visit VehicleServicePros.com/21031831

» **Improved access in tight spaces**

The **Milwaukee M12 FUEL Stubby Impact Wrenches** are designed to allow improved access in tight spaces, while delivering the power to complete demanding tasks. These wrenches deliver up to 250 ft-lbs of breakaway torque to remove stubborn bolts and fasteners. A four-mode drive control feature gives users the versatility to switch between modes to match the power and speed needed for the application at hand. These impact wrenches offer an auto shut off mode to prevent over-fastening of bolts. The M12 FUEL Stubby Impact Wrenches are available in 1/4", 3/8" and 1/2" sizes.

➔ For more information visit VehicleServicePros.com/21026208



» **Fully textured for enhanced grip**

The **SAS Safety Derma-Vue Extra Strength Hi-Vis Disposable Gloves** are designed to deliver high performance, outstanding wear, dexterity and offer the same formula as the company's Raven gloves. These gloves are fully textured for enhanced gripping power while working, and are brightly colored for high-visibility. There are 100 gloves per box.

➔ For more information visit VehicleServicePros.com/21027917

» **Blade deploys at push of button**

The **Buck Knives 112 Auto Knife** is easily deployed with the push of a button, readying the 420HC blade quickly and efficiently. The 112 Auto features the classic Macassar Ebony handle, brass bolsters and a clip point blade, and includes a leather sheath for safe carry. The blade includes a lifetime warranty and is made in the U.S.A.

➔ For more information visit VehicleServicePros.com/21023209



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» Up to 10-hour run-time

The **Alert Stamping 20W LED Rechargeable Flood Light**, No. LJR20C, features a 4,400 mAh Li-ion battery and push button dimmer with three brightness levels: 2,000 lm, 1,000 lm and 500 lm. It offers up to a 10-hour run-time, as well as a low battery and charge status indicator light. The light is rated IP54 rainproof.

➔ For more information visit VehicleServicePros.com/21008817



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» Dozens of options to fit user needs

The **Homak RS Pro CTS (Centralized Tool Storage) Combo** offers a variety of options and solutions for the user's tool storage and organization needs. This unit offers dozens of possible combinations, so users can find the right solution. The CTS transforms the company's RS Pro and Pro II Roller Cabinets into a professional work station.

➔ For more information visit VehicleServicePros.com/21028724



» For use in tight areas

The **Tekton Angle Head Open End Wrenches** are designed to improve access in tight areas, allowing users to work around obstructions with angled heads to turn fasteners and fittings in confined spaces. The wrenches 30/60 angle head saves time by allowing users to work without dismantling equipment to access tight spots. These wrenches are available in sets or individual sizes, SAE and metric. The wrenches are 100 percent U.S.A.-made.

➔ For more information visit VehicleServicePros.com/21028709



» Single point lock release

The **ATD Tools 10,000-lb Two Post Clear Floor Lift**, No. ATD2P10BSALI, offers a direct drive and single point lock release, low profile arms and spin up pads. This lift is ALI/ETL certified and includes a power unit, three stage front arms and stackable 2" and 4" truck adapters included. The lift has a 10,000-lb capacity and an overall height of 144". The lift has a 71" maximum lift height, inside column width of 116" and minimum pad height of 4".

➔ For more information visit VehicleServicePros.com/21024428



» Ideal for fleets and heavy duty vehicle maintenance

The **ATEQ VT Truck TPMS Tool** is designed to meet fleet management and maintenance demands. The VT Truck checks tire pressure and sensor batteries to prevent under-inflation and reduce vehicle downtime due to tire blowouts. The tool is compatible with most truck and bus TPMS sensors and has bimonthly updateable vehicle coverage. VT Truck displays and stores up to 22 wheels of vehicle data and can read TPMS sensors in twin wheel. The tool reads and activates the TPMS sensors by selecting vehicle brand and model, by sensor or simply by scanning all known protocols. The VT Truck comes with three years of free software and database updates.

➔ For more information visit VehicleServicePros.com/21028520



» Align up to five axles simultaneously

The **Pinnacle Automotive Systems Jumbo 3D Super Alignment System** is an imaging aligner for multiple axle trucks, buses and trailers. Utilizing imaging technology, the Jumbo 3D Super is ideal for every environment, the company says. With one short runout compensation, users can have alignment readings on all five axles in less than three minutes. With an extensive data base, easy to use intuitive software, ability to align up to five axles simultaneously and an optional car/light truck add on kit, this alignment system is suitable for a variety of shops.

For more information visit VehicleServicePros.com/21028732



» Variable speed control dial with five settings

The **Makita 5" Dual Action Random Orbit Polisher Kit**, No. PO5000CX2, includes the company's 5" Dual Action Random Orbit Polisher (No. PO5000C), three foam pads and a tool bag. The dual action control offers "random orbit with forced rotation" or "random orbit with free rotation," and the variable speed control dial has five speed settings, so users are able to set the speed and action to the application. Additional features include an electronic controller that automatically applied additional power to maintain constant speed, even under load, and also provides soft start for smoother start-ups and longer gear life.

For more information visit VehicleServicePros.com/21028743



» Long lasting edge

The **Kershaw Fraxion Knife**, designed by custom knife and toolmaker Jens Anso, is ideal for users who prefer a contemporary look and compact size. This slim design is lightweight, with a streamlined designed and light but strong G10 handles with carbon fiber overlay. An inset liner lock secures the blade open during use, helps keep down weight and maintains the handle's comfortable slimness. This knife features quality blade steel for a long lasting edge, and offers easy one-handed opening with flipper. The knife weighs 1.9 oz.

For more information visit VehicleServicePros.com/21026744



» Three-way loading

The **Flexzilla Lock-N-Load Lever Action Grease Gun** is designed for fast grease reloading. The Lock-n-Load threadless quick connect barrel lets users grease in half the time compared to other grease guns, according to the company. Slide the Lock-n-Load switch to disengage or reconnect the barrel. Notable features include automatic bleeder, heavy duty die-cast head construction, three-way loading, lightweight aluminum barrel with firm grip knurling, ergonomic t-grip follower handle and more. This grease gun holds up to a 14-oz grease cartridge.

For more information visit VehicleServicePros.com/21025039



» Durable solid rubber construction

The **Ascot OTR Wheel Chock** offers a durable, solid rubber construction and is designed for heavy duty truck and mining equipment. The wheel chock also has a 20" rope attached. This product is 12" by 10" by 12" and weighs 27.5 lbs.

For more information visit VehicleServicePros.com/21031469

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» Features temperature compensating discs

The **Thexton Professional DEF Tester**, No. 108, is a Diesel Exhaust Fluid (DEF) tester that features urea concentrate testing and temperature compensating discs that test hot or cold DEF. If the mixture is 0.7 percent off, the manufacturer suggests replacing DEF and identifying why the concentrate is off. If the DEF concentrate is not correct, the injectors may become clogged and the DEF will not work properly.

➔ For more information visit VehicleServicePros.com/21029419



» Includes tire inflators, hose reels and air hoses

The **ESCO Tire Inflation Solutions Line** includes tire inflators, hose reels and air hoses. In the inflation category, the range includes wall mounted inflators, dial and digital handheld inflators and an "automatic handheld inflator." The Automatic Handheld Inflator (No. 10963) is a rechargeable handheld tire inflation solution that allows for complete inflation of up to four tires at the push of a button. It offers a rugged design and is easy to use. In addition, ESCO offers Extreme Ultraflex Hose products that are designed and built for use in professional environments.

➔ For more information visit VehicleServicePros.com/21030712



» Offers speed, flexibility and profitability

The **Hofmann Geoliner 920 Heavy Duty Wheel Alignment System** is designed to make checking the alignment on heavy duty vehicles faster and more accurate. This balancer offers speed, flexibility and profitability, according to the company. The system mounts the targets to the floor or wall, helping to offer a faster, easier set-up time. The only devices that need to be mounted on the vehicle are the wheel clamps and measuring heads. The user-friendly interface offers real-time adjustments.

➔ For more information visit VehicleServicePros.com/21030725



» Stainless steel and abrasive nylon brush heads

The **Innovative Products of America Flow-Thru System with Brush and Venturi**, No. 8091, features stainless steel and abrasive nylon brush heads, as well as a venturi that attaches to an ergonomic, anodized-aluminum handle with integrated flow-control valve to clean, restore and apply solvents under pressure. This system offers improved cleaning action in a parts-washing sink or portable cleaning anywhere air supply is available. This tool is ideal for applications including parts washing, degreasing, on-engine cleaning and fluid evacuation.

➔ For more information visit VehicleServicePros.com/21030717

» Dual-action cleaning system

The **WD-40 Specialist Fast-Acting Carb/Throttle Body and Parts Cleaner** is an all-in-one cleaner spray for cleaning the carburetor, throttle body and unpainted metal parts. The product's dual-action cleaning system breaks up tough, baked on carbon deposits and blasts away waste without leaving behind a residue. This spray is ideal for both old and new vehicles and equipment.

➔ For more information visit VehicleServicePros.com/21030721



» For indoor and outdoor use

The **Reelcraft Series L NM400 Cord Reels** are NEMA 4 rated and designed for indoor and outdoor use. The reels include a guide arm that is adjustable every five degrees over a 270 degree arc, allowing for the exact configuration to suit a wide range of applications. The containerized drive allows for safer, easier handling during maintenance. The heavy duty cast aluminum design and yellow powder coat finish help make this a rugged, corrosion-resistant product.

➔ For more information visit VehicleServicePros.com/21028739

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» Handle vibrates when target torque is reached

The **GEARWRENCH Electronic Torque Wrench with Angle** is available for 3/8" and 1/2" drives. It features three modes of operation: Peak Torque, Angle and Peak Angle. Torque accuracy is 2 percent clockwise, and 3 percent counterclockwise in the 20 to 100 percent range. The 72-tooth gear provides a five-degree ratcheting arc. An audible tone goes off as the target torque value is approached, and when the target is reached, the handle vibrates, a beep tone sounds and the screen display changes color to help ensure accuracy.

➔ For more information visit VehicleServicePros.com/21031215



» Seven percent lighter than previous generation

The **Chicago Pneumatic 3/4" Impact Wrench**, No. CP7769, is designed to be more compact, ergonomic and seven percent lighter than its predecessor, the company says. This wrench provides up to 1,440 ft-lbs of maximum torque and is designed with a twin-hammer mechanism to improve durability. All controls, including a variable speed trigger, can be adjusted with one hand, in any position, to help reduce fatigue on the operator's wrist and arm, and improve use in tight spaces. This wrench is also available with a 6" anvil (No. CP7769-6), and in a 1" version (No. CP7779).

» For more information visit VehicleServicePros.com/21031205



» Helps ensure vehicles start after extended inactivity

The **Snap-on 4 A 6/12V DC Battery Maintainer**, No. EEBM500A, is suitable for use on stored or seasonal cars, trucks, boats, SUVs, motorcycles and more, to help ensure vehicles start when needed, even after extended inactivity. It is compatible with conventional lead-acid, maintenance-free, AGM, gel cell and deep cycle batteries, and feature a quick-connect output cord with a clamp set, ring terminal set and 12V adapter output accessories. An LED charging status display indicates when the charge is complete.

» For more information visit VehicleServicePros.com/21031792



» Built-in power inverter powers personal electronics

The **Michelin Multi-Function Portable Power Source XR1** offers a variety of features in one compact device. Notable features include: a jump starter with 40" long heavy duty jumper cables and 300 cranking amps; built-in power inverter that provides AC power for powering personal fans and electronics; 260 psi air compressor; and digital Bluetooth radio that allows users to stream music from their phone or music player.

» For more information visit VehicleServicePros.com/21030964



» Absorbs a variety of liquid spills

The **Wurth USA Traction Mat**, No. 0713111120, is a non-slip absorbent mat that lays completely flat. With cling technology, Traction Mat is easy to install and ideal for absorbing a wide variety of liquid spills. Traction Mat comes in a lightweight 34" by 50' roll.

» For more information visit VehicleServicePros.com/21030864



» Offers centralized locking system

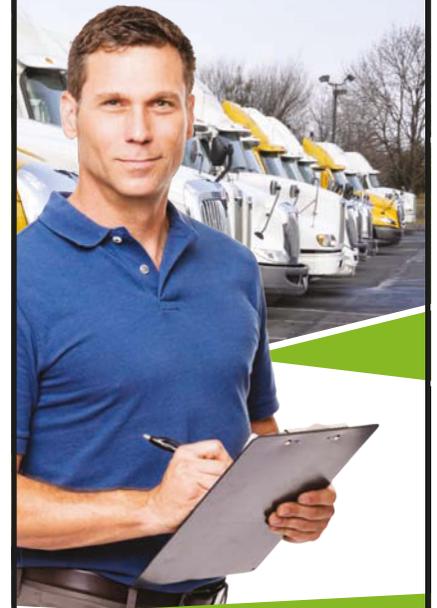
The **Beta Tools Endurance Workbench**, No. C59A, has a built-in tool storage cabinet with six drawers. The drawers are on ball-bearing slides, and there is a centralized locking system. The cabinet and bench construction are steel, and the workbench top is made from a durable wood multi-ply material that has a laminated top. The worktop also has holes for mounting the company's 1599/125 Vice. There is an open shelf on the bottom of the workbench that allows storage for larger items. The C59A is available in orange, red or gray.

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» Offers 4.5-hour run-time on high

The **Streamlight Bandit Pro** is a lightweight, hands-free worklight that offers the convenience of USB recharging, and also signals to warn that the battery is low. This headlamp offers a 180 lm output and 4.5-hour run-time on High, and 35 lm output and 21-hour run-time on low. Featuring a polycarbonate body and lens, the Bandit Pro weighs 1.6 oz. with the attached headband and measures 2.7" in length. The light is IPX4-rated for weather resistance and is impact resistance tested to two meters. The light includes a snap-in hat clip adapter to attach to the brim of a baseball cap, and is available in safety yellow and black.

» For more information visit VehicleServicePros.com/21031190



» Offers Rc55 drilling capacity

The **ProMAXX PowerDrill 29-pc Drill Set** is a drill bit kit with a variety of sizes. This set features precision ground points, flutes, clearance and drill diameters and a larger composition of cobalt to boost drilling capacity to an Rc55. Each bit is machine turned and ground for dead flatness, ensuring the bits won't "walk," according to the company. The sizes start at 1/16 to 1/2 by 64ths. This set is manufactured in the United States from American-made materials. The set includes free unlimited technical support.

» For more information visit VehicleServicePros.com/21031840

CONNECTING TO THE FUTURE



» Removes seized TPMS valve stems

The **Dill Air Controls TPMS Hex Nut Removal Kit**, No. 5010, removes seized TPMS valve stems. The kit includes a drill bit with specialized stop feature, a custom CNC machined drill guide, 'easy-out' tools, wheel protecting O-rings and a user's guide. The Dill 5010 is designed to eliminate the need for a cut-off wheel or a hammer and chisel, and the company says removal can be done in 30 seconds with use of the kit.

» For more information visit VehicleServicePros.com/21030962

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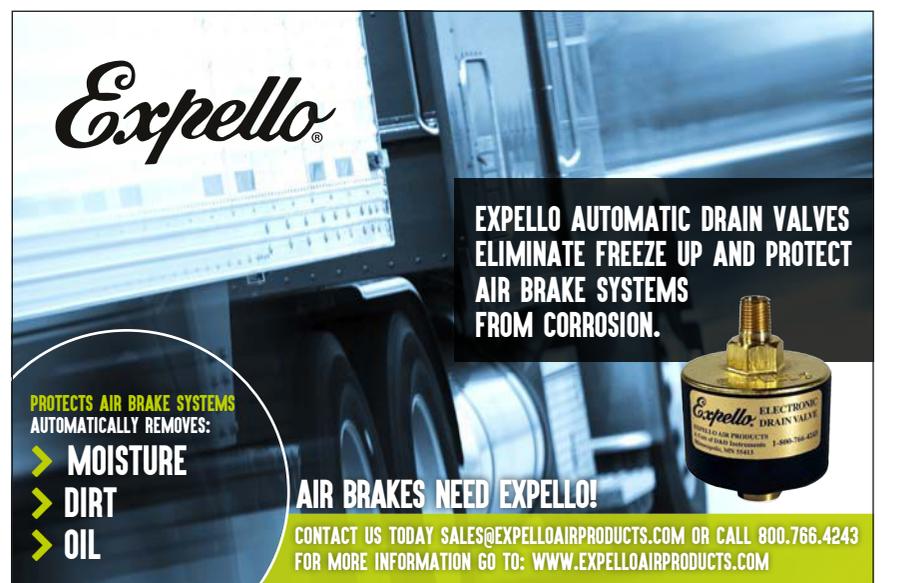
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Six critical factors that cost fleets money

Irregular tire wear can be attributed to a number of issues.

Tire maintenance can have a major impact on the cost of operations for a fleet. The overall goal of any fleet should focus on maintaining all tires at the fleet target inflation pressure based on the manufacturer's application data book for the particular axle load. When monitoring inflation pressure, well-maintained fleets keep the tires within 5 psi of this setting,

» When conducting tire checks, it is critical to ensure all tires are at the fleet target inflation pressure based on the manufacturers' application data book for the particular axle load.

Image courtesy of Michelin

and not more than 5 psi different than the dual tire next to it in operation.

To ensure safety and efficiency, fleets should consider the following six major areas when optimizing tire maintenance.

1. Low inflation pressure

Under-inflation is the biggest issue in the commercial vehicle industry. It is the number one cause of premature tire removal. With the advancement in today's radial casing, it is virtually impossible to determine if a tire is properly inflated without using a pressure gauge. Periodically calibrate the gauges using a master gauge. Over time, usage conditions can cause a pressure gauge to lose accuracy beyond the 2 psi manufacturer's tolerance range. The time and effort required to verify gauges and to check tire pressure is time well spent.

Effect: An inflation pressure mismatch of greater than 5 psi will result in the two tires of a dual assembly being significantly different in circumference, resulting in irregular wear. This mismatch can also lead to eventual tire loss due to premature casing fatigue. A difference of 5 psi between steer tires will cause the vehicle to pull to the side with the lower pressure. Additionally, under-inflation results in internal tire heat buildup and potential premature tire failure.

Goal: Maintain all tires at the fleet target inflation pressure based on the manufacturer's application data book for the particular axle load.

2. High inflation pressure

Over-inflated tires increase the likelihood of crown cuts, impact breaks, punctures and shock damage resulting from the decrease of sidewall flexing and an increase in firmness of the tread surface.

Effect: Over-inflation can increase the probability of potential casing damage. This change in contact patch footprint could result in a reduction of traction and tread life.

Goal: Maintain all tires at the fleet target inflation pressure based on the manufacturer's application data book for the particular axle load.

3. Missing valve caps

Missing valve caps are a primary source of low inflation pressure. Valve caps are used to keep debris out of the core and act as a secondary

air seal if the valve core happens to leak. Verify there is a tight seal by using a spray-type leak detector. A good metal cap with a rubber seal will hold tire pressure without a valve core.

Effect: The number one cause of tire pressure loss can be attributed to missing valve caps. Operating without valve caps can result in under-inflation and the conditions mentioned above.

Goal: Install suitable valve caps on all wheel positions. Consider the use of inflate-through valve caps for easier pressure maintenance.

4. Dual mismatch inflation pressure

Dual mismatched pressures can cause permanent irregular wear patterns to develop. Within a few weeks, this irregular wear can potentially be a cause of early tire removal. Dual mismatched pressure will also impact the matched tire, causing accelerated tread wear and casing fatigue.

Effect: This irregular wear can result in early removal or require tire rotation to minimize the effect.

Goal: Maintain all tires at the fleet's target inflation pressure based on the manufacturer's application data book for the particular axle load. Well-maintained fleets keep the tires within 5 psi of this setting when monitoring inflation pressure.

5. Dual mismatch height

Dual mismatch tread depths (tire height differences) will cause irregular wear. Additionally, the larger tire (the one with the greatest tread depth) will become over-fatigued due to bearing more weight. This accelerates premature casing failure.

Effect: Dual mismatch tread depths can cause a permanent irregular wear pattern in a few weeks, resulting in early removal or a lost casing.

Goal: Match tires in dual assembly with equal tread depths. Well maintained fleets use +/- 4/32" of tread depth as the maximum allowable difference in overall height between the duals.

6. Irregular wear

Proper inflation pressure, correct toe settings and proper alignment can prevent most irregular wear. Steer, drive and trailer axle alignment verification and correction can be performed with a minimal cost or investment in equipment.

Effect: Once a wear pattern develops, it will continue until the tire is rotated or removed to be retreaded or scrapped. Diagnosis and correction of the cause is part of the solution in preventing future conditions. Average occurrence of irregular wear typically results in a loss of tread life, resulting in a much higher total cost of ownership.

Goal: Reduce irregular wear by following proactive tire and vehicle maintenance programs. ■



By Paul Tatarchuk
SPECIAL SERVICES COORDINATOR,
MICHELIN HEAVY TRUCK TIRE CUSTOMER
ENGINEERING SUPPORT GROUP

Michelin designs, manufactures and sells tires for every type of vehicle, including airplanes, automobiles, bicycles, motorcycles, earthmovers, farm equipment and heavy duty trucks. Paul Tatarchuk is special services coordinator for the Michelin Heavy Truck Tire Customer Engineering Support Group. Tatarchuk has worked for Michelin for more than 13 years. Starting in passenger car OEM tire project management, he moved to Michelin's headquarters in Greenville, South Carolina in 2015.

Online Exclusive

To view a gallery of different common wear issues for drive, steer and trailer tires, visit:

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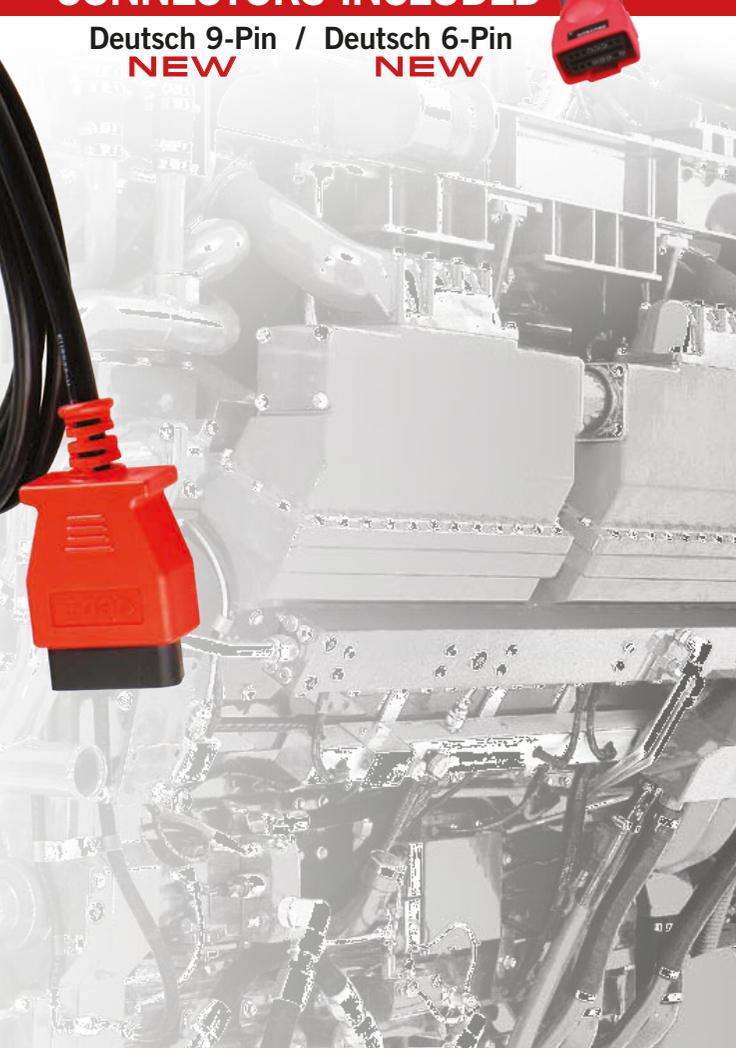
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