

‘Maintenance-free’ LED headlights still need TLC

LED headlights are typically maintenance-free, but wiring problems can wreak havoc under the hood.

By John Hitch

For the 2021 International Roadcheck, the Commercial Vehicle Safety Alliance tasked its certified inspectors across the U.S., Canada, and Mexico to make lighting out-of-service violations a priority. In the U.S., these CVSA inspectors logged 9,691 out-of-service violations, with lighting (headlamps, tail lamps, stop lamps, turn signals, and lamps on projecting loads) as the third most frequent—following brake systems and tires—accounting for 14.1% of the violations. This is up from 13.5% in 2020. Canada nearly doubled lighting OOS violations from 7.5% in 2020 to 12.4% in 2021, while in Mexico, lighting was the top offender, responsible for 54% of the 72 total violations, up from 22.8% in 2020.

What this all means is that fleets need to take a closer look at their trucks’ lighting, particularly their headlights, so their drivers can safely see the road—and potential dangers—ahead.

The vast majority of new vehicles employ LED (Light Emitting Diode) headlamps—95% accord-

ing to vehicle lighting manufacturer Optronics International—and a major selling point is that LEDs are maintenance-free for life. That said, they still require some tender loving care (TLC).

“LED lighting is pretty much the same as incandescent,” said Kyle O’Dell, director of engineering and new product development at Optronics International, a lighting manufacturer. “They just require less power and are much more efficient, much brighter, and much crisper lighting.”

LED lighting is solid state and does not use filaments, so lamps will not fracture due to the excessive vibrations and stressful conditions common in the CV market, explained Paul Sniegocki, EVP of engineering and CTO at Clariance Technologies, parent company of Truck-Lite.

Truck-Lite developed LED signal lighting and harnessing in the mid-90s, with LED headlights for military vehicles coming in the mid-2000s. “You can imagine how fragile a 24-volt filament is in some of the theaters in which they were operating,” Sniegocki recalled. “And there was this very significant failure rate of these incandescent headlamp systems.”

These robust headlamps then carried over to commercial vehicle applications. Truck-Lite became the first to offer lifetime warranties for its CV lights and harnesses.

But the technological advances within the module don’t make the fragile wires connecting them to the rest of the truck any less vulnerable. And it gets rough under a truck, with rocks, debris, and road salt all coming into contact with the lights’ wires and harnesses.

» LED lights are touted as maintenance-free, which is true, but the wires connecting them to the truck’s electrical systems still need routine inspections and repairs.

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» Grote’s Western Star 47x/49x SFA Headlamps with Deicing

Photo: Grote Industries





» A custom Truck-Lite LED headlamp for Hino.

Photo: Truck-Lite

“Corrosion is the biggest factor when it comes to lights and CSA violations,” explained Dan Miller, field services/special projects manager at Peterson Manufacturing, which makes commercial vehicle and trailer harness and lighting systems. Peterson launched a modular harness system for trailer lighting called the PetersonPATRIOT last year, with a waterproof design specially defending against water and highly corrosive magnesium chloride (a chemical that helps road salt stick).

Along with corrosion, the TMC Recommended Practice 186—Wire and Cable Repair Guides—said that excessive heat, vibration, and routing issues can damage wires, terminal seals, and connector bodies. Whatever the cause, the issue creates plenty of work for maintenance shops.

“Wiring repairs for lighting are honestly one of our most common repairs,” said Lucas Coyle, master technician at TA Truck Service in Gaston, Indiana. “We constantly have corrosion and cut wiring issues.”

In the sidebar to the right, Coyle, a bona fide luminary when it comes to fixing lighting problems, explains how to resolve wire repairs. But the first step to addressing these issues is through pre-check inspection by the driver and scheduled visual inspections by maintenance professionals during routine checkups.

Inspections

According to Marcus Hester, chief marketing officer at Optronics, basic visual inspections are often overlooked despite their effectiveness. Along with a walkaround to ensure all lights are on and operable, he advises inspecting the harness and connections. This should be done during annual preventive maintenance inspections, and technicians should key in on a few areas, according to O’Dell: “On the harnesses, the main areas you’ll see nicked wires and things like that are where they go through fittings, or through plates that don’t have grommets, aren’t properly insulated, or have convoluted tubing.”

Nicks create a major point of entry for corrosion, so any damaged wires should be cut and replaced or repaired, O’Dell advised.

Neatly organized wiring will make inspections far easier.

“You’ve got to keep the wiring secure and up out of harm’s way,” noted Miller, who railed

“You start looking at this rat’s nest of multiple wiring repairs, where people have gone in and repaired things, probably in the heat of battle, and that was not done correctly, which causes all kinds of other issues down the line.”

Dan Miller, Peterson Manufacturing

against “conglomerations of wiring,” the result of hurried fixes. Perhaps this happened during an emergency service call after a tire blew and forced the mudflap into the wiring and damaging it, he theorized.

“You start looking at this rat’s nest of multiple wiring repairs, where people have gone in and repaired things, probably in the heat of battle, and that was not done correctly, which causes all kinds of other issues down the line,” Miller said. He advised that the tech should cut out all the wiring that was improperly repaired in order to remove the bad splicing and eliminate the moisture/corrosion entrance points. This will help fleets avoid lost time and money.

He also said certain test tools can cause unintended problems.

“We need to throw away all the probe test lights, because when you stick the wire, it creates a path for moisture [and] creates a path for corrosion,” Miller asserted. “You might not have a problem today, but you will tomorrow.”

Repairing wires

Tips and tricks for technicians when the time comes to fix damaged wiring.

So, what to do when damage to wiring is detected? If it’s greater than 10-gauge, TMC RP 186 recommends replacement. For low-voltage J1128 wiring 10-gauge and under, a proficient technician can splice and fix. Tools needed include wire cutters, strippers, soldering gun, dual wall polyolefin heat shrink tubing rated 257 degrees Fahrenheit, and a heat shrink gun.

There are two suggested splicing techniques: the J-hook or the Lineman’s splice. For the J-hook, slide the heat shrink over one side, remove the damaged wire, and strip away 3/8-in. of insulation on each end. Curve the wire ends into a “J” shape and hook them together. Twist the tips around the opposing wire and give them a tug to ensure tightness. For the Lineman’s splice, strip a half inch of insulation and cross the wires, and bend the ends over each other several times. In both cases, solder over the new connection, remove any burrs, and slide the sheath of heat shrink over the area and blast away with the heat gun. Then test the circuit.

TA Truck Service Master Technician Lucas Coyle, who earned top spot in the lighting category at TMC SuperTech 2021, found heat shrink insulated solder butt connectors provide a quick and easy alternative solution.

“This does not require crimping, so there is little room for damage to the shrink insulation,” Coyle said. “The connector requires just a clean cut, stripped wires, and a heat gun.”

“I use a helping hand tool that holds both wires still with alligator clips while I make the repair,” he added. “That way, the solder has time to solidify. Depending on the location of the needed repair, these can be difficult to use without removal of the harness or wiring section.”

A little more time invested now can pay dividends in the future.

“The extra time spent on a quality repair is always worth it in the long run,” Coyle offered.

Headlamp installation and replacement

Obviously, the best way to install headlights is by following the manufacturer instructions, but there are a few general guidelines. First, pick what type of light: LED or incandescent.

“An LED light is interchangeable with an incandescent,” stated O’Dell, who then discussed the added benefits. “Moving to LED, you don’t draw as much power, which can be used for telematics systems and different things to improve efficiency. Your alternators don’t have to work as hard to power that battery, or replenish what the lights are drawing.”

He said while lighting has been seen as an afterthought and only addressed when a light goes out, fleets can be more proactive and realize a better total cost of ownership.

“There’s a lot less maintenance with the LEDs just because we do have lifetime warranties,” O’Dell said. “And you’re using surface-mount components now on the LED, so you’re not having breakage and failure issues like we see on incandescent.”

Along with less amperage draw, savings can be found by switching to thinner gauge wire, which use less copper. The raw material which increased 34% in price from 2020 to 2021, according to the International Monetary Fund.

LEDs are really easy to install, though the modules are about quadruple the price of incandescents, Coyle noted.

One tip Coyle offered was to not overtighten the rivets, as that will cause them to sit and spin the fiberglass mounting. They would have to be removed and replaced with an oversized rivet and washer, which could make future work on the component more difficult. Using a hand tool, not a power tool, is strongly advised to limit your torque.

“Always be cognizant of that, because what I’ve always tried to teach my guys is if you’re working on this truck once, you’re probably going to work on it again,” Coyle said. “Don’t make it a pain in the butt the second time around because you just did something silly.”

LEDs also require a bit of computer work as well.

“If the tractor was spec’d with an incandescent light, the control module is programmed that way,” Miller said. “So, you just don’t pop in the LED, you have to go in and reprogram the light control module or you get a fault code.”

Reprogramming is done with the truck maker’s proprietary software and a laptop.

The installer also will want to make sure the headlight is at the right height and angle, crucial to help road visibility in dark conditions.

“For LED headlamp systems, as well as all of the LED signal lighting, there’s a positive locking feature on the connection,” Sniegocki said. “One of the reasons that you’ll

see flickering of lights [on a vehicle with LEDs] is that connection is not intact, as it’s vibrating down the road. The positive locking connector can seal from the environment and secure the connection in place, to eliminate that as a failure mode.”

Shops also need to carry a headlamp aiming system to verify proper alignment of headlights

according to National Highway Traffic Safety Administration requirements.

Diagnosing

LED headlights themselves have a significant level of protection built into the circuits and lamp architecture, along with self-diagnostic



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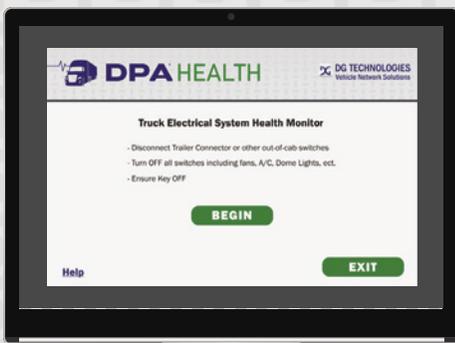
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» Always perform a voltage and resistance check prior to using a multimeter.

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capabilities done on the lamp driver board, Sniegocki explained. “They’re able to provide and deal with the electronic noise that might occur throughout these systems,” he said. “And they’re able to filter that and provide only the necessary signals back to the diagnostics architecture on the truck itself.”

This protocol includes not only power and ground to the LED headlamp, but the CAN bus or LIN bus protocols depending on the vehicle architecture.

Technicians will always want to make sure one tool is nearby to diagnose headlight issues: a multimeter.

“The multimeter will tell you if you have your voltages correct—not just that you have voltage, but if you have the correct voltage,” Miller said. “When technicians go through the troubleshooting steps with the proprietary software of the manufacturer, it’s going to ask them what the voltage is, because that *means* something.”

Coyle agreed: “Keep that multimeter in your back pocket, because you’re going to need it.”

The multimeter itself requires a quick check to ensure it is working properly. Coyle advised to do “a quick voltage and resistance test with your leads to make sure your meters work.”

Coyle always trains his technicians to “go back to the basics” and reminds them to always check if the power side has voltage and ground side does not.

“You can cut diagnostics down very quickly with just a couple of quick tests,” said Coyle, who explained how OEMs’ software provides active and inactive fault codes emanating from the headlamp module.

Other systems can become impacted by issues with the headlamp electrical system. “The module can shut that circuit off if there’s a short causing the circuit to be damaged,” Coyle said.

Coyle explained one time he ran into an issue where all the lights, the horn, and steering wheel

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Lucas Coyle, master technician,
TA Truck Service

switches on a Freightliner Cascadia were not working because the clock spring caught fire, melted some wires, and shorted the data link. Once he unplugged the burnt component, everything began to work.

To further speed up lighting troubleshooting, Coyle built his own specialized diagnostics cart.

“I bought a really cheap, really small flat-screen TV and put it on one side and a laptop tray on the other,” he explained. “That way I’ve got my computer set up so I can have wiring diagrams up on one side and fault codes and diagnostics on the other side.”

This helps Coyle better understand if a circuit is out, where it gets power from, and helps him identify if there are any common issues in other circuits.

He found that technicians often do not test wire resistance under a load. For small wires, Coyle uses the Electronic Specialties LOADpro tool.

“The LOADpro uses the truck-supplied power and ground on the circuit to make a connection across the multimeter leads,” he said. “This allows the circuit to be in a loaded state, and you are able to monitor a voltage drop on your multimeter without having to back probe the circuit. This can make voltage tests a lot easier, and you are less likely to damage the seals to the wiring terminals.” ■