

G R E M L I N S A

How to combat electrical issues on modern trucks

New technology on trucks is creating new challenges for proper electrical system maintenance. Here's how to stay ahead of the curve.

by Jack Roberts

[BATTERY & ELECTRICAL]

During World War II, U.S. aircrews coined the term “Gremlin” to describe random, untraceable technical issues that arose on their airplanes – problems that were very often electrical in nature and exasperated by the extreme temperature and environmental conditions the aircraft performed in.

Sound familiar? Well, thankfully, the risks involved in trucking are considerably less than onboard a military aircraft; getting out of a stricken vehicle doesn't involve a parachute, for one thing. But fleet technicians today can surely relate with those 1940s aircrews when it comes to chasing down ghosts and gremlins in modern electronic systems on vehicles.

Electrical issues have been giving truck technicians sleepless nights ever since the first magnetos and primitive wiring harnesses were run through a chassis to provide power for lights, instruments, and other vehicle systems. Today, with trucking in the midst of an accelerating technological revolution centered on ultra-fast, highly complex electronics, the nature of electrical system maintenance is undergoing its own transformation. And while truck electronics systems are becoming increasingly critical for vehicle uptime, they don't seem to be getting any easier to troubleshoot and repair.

Getting past the pain points

“Electronics have always been a pain point for fleet maintenance professionals,” says Kristi LaPage, business manager, commercial vehicle group, Mitchell 1. “To a large extent, the electrical system has always been the nervous system of a vehicle. And they've always been complex and difficult to work on. Although we've seen a lot of advances in electronics troubleshooting over the past several years, the reality is that these systems will always be a time-consuming problem for most fleets.”

As vital as electrical systems are in our society, the simple fact is they do not do well in the harsh work conditions commercial vehicles are forced to endure. Electrical systems, wiring, conductors, and connectors do not like excessively hot or cold temperatures. They don't like the elements. And they don't like vibrations. Their necessarily delicate protective casings often allow water, dirt, grease, soot, and other contaminants in, which quickly leads to failure. And despite countless efforts to design and deploy wiring that can withstand these harsh operational realities, the fact remains that electronics are a vital, yet unbelievably delicate and temperamental operational system on vehicles that work in some of the toughest, and most unforgiving conditions on earth.

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» With trucking amidst a technological revolution centered on complex electronics, electrical system maintenance is undergoing its own transformation.

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N D G H O S T S



To make things even more frustrating for technicians, conditions that can cause electrical systems failures are often highly intermittent in nature, explains Jason Hedman, product manager for Noregon. For example, he notes, a wire that is wet may carry a current just fine when it is dry. Likewise, a failure caused by a wiring harness vibrating rapidly at highway speeds may be undetectable when the truck is sitting still in the shop.

“This aspect of troubleshooting electrical systems has always been particularly challenging for technicians,” Hedman says. “A problem can occur on the road, and be faithfully reported by the driver. And then it can’t be replicated in the fleet shop or at a third-party service supplier. Technicians can spend hours crawling over and under a truck trying to figure out what the issue is.”

That’s assuming you’re even working with the wire or component that’s actually experiencing problems. As LaPage points out, trucks are mass-produced consumer items that can be spec’d with many different electrical options.

“Working with wiring is always easier when you have a nice, clean system on your hands,” she notes. “But within any wiring harness, there are almost always wires for optional or deleted systems that are not being employed at all. So, for many technicians, half the battle is often simply figuring out which wire they need to focus on.”

“Electrical system troubleshooting is a massive time suck for fleets,” agrees Brett Miller, engineering manager, Optronics International/USA Harness International. “A big problem is that many of them are still using old methods to determine what the issue is. But sticking a probe through a wire casing to see if current is getting through ultimately creates more points of entry for water, dirt, and other elements that can eventually compromise an entire wiring harness. Fleets really need to adopt better ways of understanding what problems they’re facing, instead of spending excessive time casting around and hoping to hit on the issue – which is what happens most of the time.”

“Historically, corrosion has made testing components difficult for two reasons,” says Cory Adams, vice president of engineering, Peterson Manufacturing. First, he explains, separating corroded components can be difficult and sometimes impossible without breaking the connectors and components. “And second,” he says, “trying to find a damaged wire across hundreds of feet of wire on a trailer is tedious and time-consuming which causes extended trailer downtime and increased cost to repair. Checking each and every wire in a system while trying to track down electrical issues can prove to be quite laborious.”

“Additionally, when moisture enters a wire it spreads across the entire system by the capillary effect,” notes Adams, in reference to the ability of a liquid to flow in narrow spaces without the assistance of, or even in opposition to, external forces like gravity.

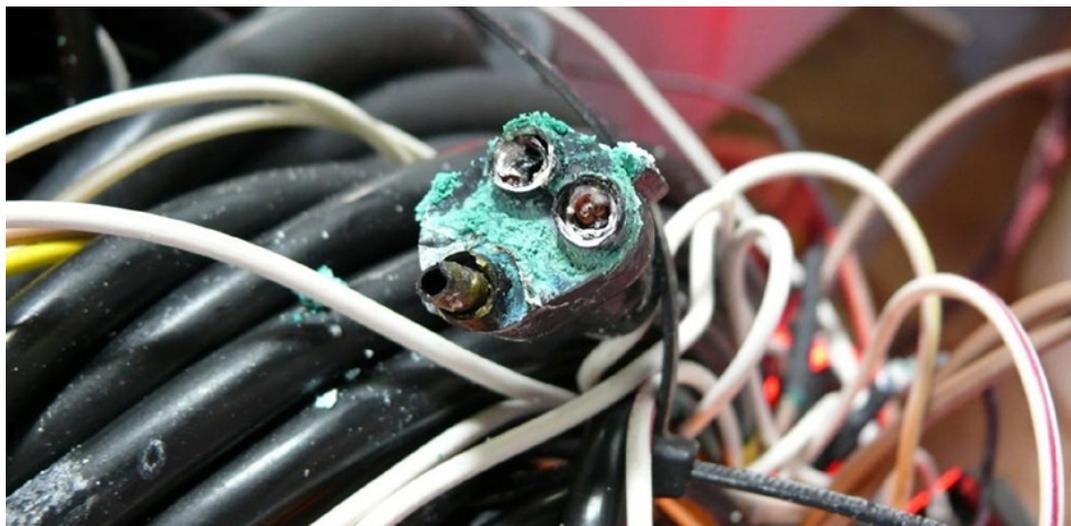
All of which means damage to one wire can cause corrosion across the entire system if given enough time.

“Technologies, like Peterson’s Integrated Moisture Barrier, that limit this propagation



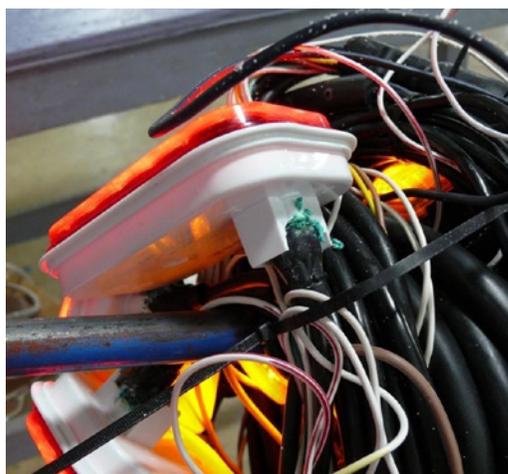
» One good strategy for mitigating electrical issues is to periodically check all connections and plugs on a fleet’s vehicles and replace them with newer, more weather- and corrosion-resistant components.

Photo courtesy of Peterson Manufacturing



» Plugs and connectors are a common weak link in vehicle electronic systems.

Photo courtesy of Optronics International



» One approach for cutting down on electrical issues is to adopt a dedicated PM program and swap out older style plugs and connectors for newer ones that offer greater protection from the elements.

Photo courtesy of Optronics International

of moisture can reduce the damage caused by moisture entering the system at a single point,” Adams says. “Additionally, harnesses that are modular allow the technician to replace the damaged wire in a quick and easy way, saving labor hours and stopping the wicking of moisture to other components including your lights.”

Another problem is that new technology often means relearning maintenance truisms and procedures that have been in place for decades. A good case in point, the introduction and fast adoption of new LED lighting systems on trucks has unintentionally created maintenance headaches for some fleets, says Kyle O’Dell, director of engineering and new product development, Optronics International/USA Harness International.

“The issue is that conventional, incandescent light bulbs draw more power than LED bulbs – which is one of the key benefits to switching over to LED systems,” O’Dell explains. “However, some

self-diagnosing vehicle systems interpret that low power draw as a signal that a perfectly healthy bulb is out all the time because the old power draw simply isn't there. And you end up with technicians chasing ghosts for hours over a fundamental misunderstanding of the differences between LED and incandescent lighting systems."

A blend of old- and new-school procedures

Although lighting and electronics systems will likely always be a bottleneck in fleet maintenance operations, maintenance system service providers and OEMs alike are working continuously to make troubleshooting and repairs faster and easier to complete.

Perhaps the greatest advancement in recent years has been telematics systems on trucks, which relay vital information about component failures back to fleets, service providers, and OEMs in real time. As a result, Peterson's Adams says, the time to track down electrical issues on trucks has been reduced. "Additionally, smart trailer systems will also warn drivers and fleets when there are problems, and most problems are easier and less expensive to fix if you find them early," he adds. "This goes for driver routine maintenance as well as technician level maintenance, such as the need [to add] air to a tire before it overheats, lube hubs before they cause a thermal incident, and other issues."

New remote diagnostics are now playing a major role in improving vehicle safety by catching electric or lighting issues as they happen – or in some cases, before they even malfunction.

As Hedman explains, because truck lights are now attached to smart systems, they can send fault codes to the user, so fleets don't have to wait for the driver or someone else to notice a burned-out light. In some instances, intermittent faults may hint toward a looming failure and prompt the fleet to change the bulb or make a repair before it becomes a safety concern.

"Advanced aftermarket diagnostic tools have not only

made it easier to detect electrical issues by simultaneously scanning all components, but have also improved in capabilities that assist the user with the diagnosis," Hedman adds. "Technicians can use a single application to scan the truck, locate the affected wiring harness using suggested troubleshooting steps, view the harness's wiring diagram, and then chart data points or use rele-

vant bidirectional commands like a wiggle test to find the damaged wire."

Using this new technology, Phillips Connect has introduced its Light Out system, which Cliff Creech, director of sales engineering at Phillips Connect, says continually monitors the lights on a vehicle and stores a 30-day history of faults that are continually reported to fleet operations.



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“When the vehicle is serviced, this information can be accessed by the technician giving him/her a clear indication of what the problem is, which they can then address and fix,” he notes. “This saves time and more likely results in the proper lasting repair.”

Just as vital, Creech says, are new data management and storage capabilities offered as part of maintenance diagnostic systems today, which can also cut critical time off electronic troubleshooting and repairs.

“When fleets have to rely on outsourcing their maintenance, either as a regular practice or because of on-road issues including having the vehicle put out of service at a checkpoint, lighting and electrical issues can become something of open-check for the provider and resurface down the road if the right repair is not made,” he notes. “Without the monitoring documentation new telematics systems provide, it’s unknowable if the service being provided is appropriate to the problem and can lead to lost time trying to repair a ‘ghost’ issue.”

Other telematics solutions like Phillips Connect Smart7 Remote Pre-Check advises a fleet if one of their trailers has lighting or electrical issues before it is dispatched to haul freight, Creech adds.

“In addition to not wasting the time of the driver to pull a trailer that is not road-ready, the data can also suggest to the fleet what is wrong, so when maintenance is scheduled they know what they need to fix,” he notes.

Just as important is expediting how technicians access the complex information required to track down wiring issues. To help, LaPage says Mitchell 1 is also leveraging new technologies like its interactive wiring diagrams, which she says can significantly save time in diagnosing and repairing electrical problems.

“When viewing one of our wiring diagrams, technicians can click on any component or wire within the diagram to see a pop-up menu with selections to learn more about specifications, component location, connector views, guided component tests, and more,” she says. “There is no need to exit the wiring diagram to find related information needed to diagnose the issue. And if that examination turns out to be a dead-end, the technician is automatically returned to the correct diagram to continue checking for other issues – all without having to initiate a secondary search.”

Many technicians have struggled with diagnosing electrical systems on trucks because they either selected the wrong tool or were never properly trained on essential tools like a digital multimeter (DMM), Creech adds. “Too often, technicians poke around a wiring harness until they’re able to detect a problem, which can lead to bigger issues such as damaging the harness or other wires,” he notes. “Using the tools at their disposal, such as a diagnostic application and a multimeter, takes much of the guesswork out of diagnosing electric systems.”

For solving electrical issues, Creech says Phillips engineers strongly recommend investing in tools that facilitate holistic diagnosis.

“Because communication issues can affect multiple systems on a vehicle, the ability to simultaneously diagnose all truck components



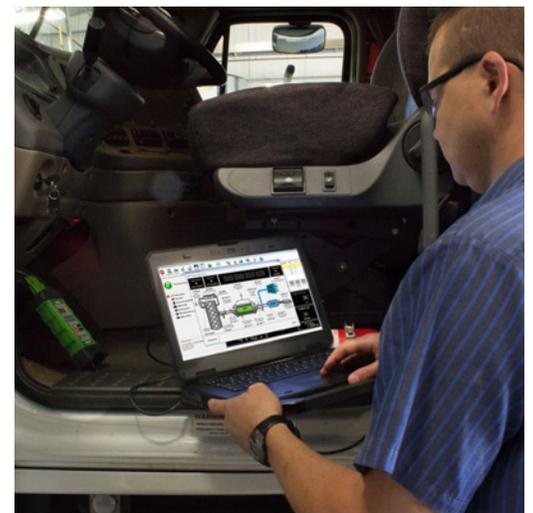
» For solving electrical issues, it is strongly recommended to invest in tools that facilitate holistic diagnostics.

Photo courtesy of Power Probe



» New LED bulbs offer tremendous uptime opportunities for fleets, but their low amperage draw compared to conventional bulbs can create “ghost” issues for technicians.

Photo courtesy of Optronics International



» New diagnostic tools and interactive wiring diagrams are making troubleshooting and repairing electrical issues on trucks easier and faster than ever before.

Photo courtesy of Noregon

helps uncover the root cause of electric problems,” Hedman says. “That’s why we feel it’s best to invest in a diagnostic and repair tool that provides the user with everything they need in a single application to complete the job. For example, [Noregon] JPRO’s Fault Guidance feature presents the user with troubleshooting steps, plus valuable information like full-color wiring diagrams to improve technician efficiency.”

Optronics’ O’Dell says that in his experience, the weakest links in a truck’s electrical system are the links between wiring and vehicle systems – the molded plugs and hard-shell connectors that often attract dirt and debris, or allow water inside. He recommends replacing them with more modern, and better protected connectors as part of a prescribed preventive maintenance (PM) regimen for the fleet.

“Most fleets simply repair lighting and electrical issues as they come up, and don’t really have a dedicated, coherent, long-term PM program designed to combat these problems,” he says. “I advise fleets to establish an annual vehicle electrical inspection schedule – perhaps every two years or so, depending on your operation.”

During this electrical PM inspection, O’Dell says technicians should go through every connector and light socket on the vehicle and have them simply pull the plugs apart, inspect them for damage, clean them, and put new electrical grease in to help protect them from the elements. “And that’s a good time to swap out any older connections for newer ones,” he adds. “It’s a simple, old-school approach to dealing with electronic ghosts.”

But, in his experience, O’Dell says such a hands-on approach can pay big dividends in decreasing failures and downtime caused by electrical gremlins and ghosts. ▀

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Cliff Creech, director of sales engineering at Phillips Connect

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