

Fighting corrosion within a vehicle's electrical system is like facing an insidious enemy who never gives up

“Corrosion is like an enemy who is always on the lookout to exploit even the slightest weakness in your defenses,” says Brett Johnson, president and CEO of Optronics International, a leading manufacturer and supplier of heavy duty LED vehicle lighting. “And when the right safeguards are not in place to fend off corrosion, just like in combat, it can overwhelm you and invade the areas you are trying to protect.

“In short, the lifespan of an improperly protected electrical system can be nasty, brutish and short.”

Johnson compares a vehicle's wiring and harness system to a theater of war. He explains that corrosion-producing moisture is always looking for ways to breach the system and once in, can run rampant.

Corrosion happens when moisture makes its way into a vehicle's electrical and power delivery system. Electrical and wiring systems can be compromised anywhere along their surfaces. Leaking lamp connections, broken lamp housings / lenses, cable and wire abrasions also provide easy access to moisture. Road debris, moving parts and temperature extremes can also attack a system.

Connections on lighting and electrical systems are the first line of defense

“Moisture and corrosion usually attack an LED lamp at its most vulnerable place – its electrical connection,” Johnson says. “If a lamp is not properly maintained, it can become a casualty long before its potential service life is realized.”

LED lamps are designed to use dielectric grease and the designs of their modular connectors provide reservoirs to hold that grease. When properly used, the grease forms a barrier that resists moisture at the connection point. However, the connectors must be

inspected regularly and the grease replenished as needed. Some fleets even apply heat-shrink moisture barriers to all electrical connections to provide an added line of defense.

Winter is when the battle really heats

The fight against corrosion gets worse during the winter months as a result of chemicals used to treat icy road surfaces. Vehicles operating in the northern U.S. and Canada will inevitably find themselves in a conflict with corrosive agents during winter months.

Chemicals accumulate on equipment and electrical systems due to road spray and due to chemical exposure, corrosion is common on heavy-duty trailers, and anywhere harness system are largely exposed to the elements.

Optronics is fighting the battle of corrosion on two fronts

Optronics designs its LED lighting products to fight corrosion in two distinct ways:

1. By stopping contaminant intrusion on the outside: Minimizing the opportunity for contaminants to enter their lighting systems in the first place.
2. By standing up to contaminants that do manage to get in: Engineering lighting systems to resist corrosion, even if exposed to contaminants.

Fighting contaminant and moisture intrusion on the outside

Optronics announced that it had completed development and testing of its new LED SuperLamp Technology in 2015, during a press conference at the 2015 Technology & Maintenance Council (TMC) Annual Meeting in Nashville, Tennessee.

“With the introduction of our LED SuperLamp Technology, we’ve created a new category of super-tough, super-long-lasting vehicle lamps and we’ve done it at a lower cost than other premium lighting products,” Johnson says. “We believe that the industry deserves better than just small, incremental advancements to lighting, and this represents the type of quantum leap we are committed to delivering.”

SuperLamp Technology is the result of more than two years of research and development and sets a new standard for longevity and robustness in LED lighting. SuperLamps can resist a variety of environmental challenges that would defeat other lamps.

The lamp's performance characteristics are the result of challenging design and testing protocols created by Optronics. The four-inch round LED SuperLamp stop/tail/turn lamp has been designed to withstand assaults on its internal electrical components, while a specially formulated coating and bonding system protects its exterior lens and housing.

The electronic circuitry within today's LED lamps is vulnerable, and a variety of circumstances can cause irreversible damage. Optronics' LED SuperLamps have been redesigned to be immune from the crippling effects of [transient voltage](#), electromagnetic interference (EMI) and electrostatic discharge (ESD). The lamps also feature solid-state, surface-mount device (SMD) technology that will allow the LEDs to continue to function even if the unprotected circuit board is completely submerged in water.

Regular LED lenses and lamp housings can also degrade and fail when exposed to the array of caustic chemicals that are common in today's commercial vehicle environment.

To battle chemical-related degradation, Optronics engineered a revolutionary coating that it applies to the entire lamp, which has been specially designed to accept and bond with the coating. The coating is engineered to be highly resistant to petroleum distillates such as coolant ethylene and coolant propylene, as well as diesel fuel, battery fluid, brake fluid, transmission fluid, organic solvents, methanol, detergents, cleaners and urea.

The new LED SuperLamp has also been demonstrated to be highly resilient in tests involving UV exposure, flammability, vibration, temperature cycling, accelerated aging, high-velocity water spray, free-fall drops, humidity, salt fog corrosion, dust, thermal shock and gravel bombardment.

Fighting contaminants that breach the first line of defense

“Leading the fight against corrosion is our commitment to convert all of our LED lamps to solid-state, surface-mount device (SMD) designs,” says Johnson. “90 percent of all Optronics LED lighting products employ SMD technology, including older product models that we are continuing to reengineer with SMD.”

Even today, many LED lamps sold within the heavy-duty market today use what is commonly called “through-hole” construction. The through-hole term stems from connecting pins, or leads that extend from LEDs and the resistors the LEDs need to manage their voltage, are fitted through holes in the circuit board and then soldered. The exposed pins leave the LEDs, the resistors and thus the entire system, vulnerable to corrosion.

Lamps from Optronics using SMD technology remove two vulnerabilities from the corrosion equation. Optronics’ LEDs are mounted directly to the surface of the circuit board, eliminating exposure to connecting points. Optronics has engineered resistors out of the system altogether and has replaced them with advanced surface-mounted chip technology that is significantly more stable.

LED lamps with SMD technology like Optronics’ new GloLight, are so robust that they can continue to function even if their circuit board is completely submerged in water. All Optronics LED lamps come with a lifetime warranty and are built to be as durable as they are functional. Lenses and housings are made of tough polycarbonate material that is sonically welded to create an impermeable seal.

Non-functioning vehicle lighting makes you conspicuous and vulnerable

To a law enforcement official, inoperable lighting can give the impression that the overall state of the vehicle is less than optimal. A vehicle with a lamp out is noticeable, even from a distance and it invites an inspection. A vehicle stopped for the lighting issue, is more susceptible to a Compliance, Safety, Accountability (CSA) roadside inspection.

“Time is money and a lighting infraction starts costing immediately,” Johnson says. “Couple a stop with a roadside service call, and the time and cost impact is even greater, in fact, the cost of service fees, lost vehicle / driver productivity, fines for violations, and big points against the driver’s / fleet’s CSA scores, can all result from the failure of a \$5.00 lamp.”

A Sound lighting and electrical system puts you on the right side of CSA compliance

A well-maintained lighting and electrical system are critical to the operation of a commercial vehicle, and are also a testament to the vehicle’s overall mechanical integrity. Proper maintenance helps promote optimal vehicle performance, and when all systems are functioning properly, the potential for equipment-related CSA infractions is greatly reduced. The driver, the fleet and the general public all win.

Infractions concerning defective or inoperable lighting rank higher in importance than brakes and result in higher CSA point penalties in relationship to other infractions, according to the U.S. Department of Transportation weighted guidelines. However, a lamp outage may be a tip-off that there is a more serious problem taking place in the vehicle’s electrical system.

System modularity is a tactical weapon against corrosion and CSA violations

Modular power delivery systems are a key component in many new vehicles for very good reasons. Attempting to maintain and service a non-modular electrical system requires cutting and splicing of wires, and that can severely compromise the system.

It’s easy for even a seasoned technician to make wiring mistakes. Corrosion-promoting moisture can enter a system through splices and old junction boxes and begin working its way through a vehicle’s entire electrical system.

“Most folks don’t realize that cabling and wiring can act like a wick for moisture,” says Johnson. “Once moisture gets in, it can and will travel through the system.”

Modular systems provide a number of benefits. Flexibility is inherent in these systems, which use standardized connectors that can be snapped together to form in a wide variety of power delivery configurations.

Because the systems can be easily designed, engineers can design electrical systems that simply branch off from a vehicle's main electrical harness line. To maintain system integrity, the modular connectors use dielectric grease to prevent intrusion from moisture and road contaminants.

All Optronics' lighting systems are designed to resist moisture and chemicals used to treat road surfaces. Optronics' lamps are available with standard PL-3 and the more robust Weather Tight termination options. The connectors snap together and are designed with reservoirs that accommodate dielectric grease. The lamps, pigtails and connectors form a watertight system that maintains its integrity under the harshest and most demanding conditions.

Optronics' LED lamp designs defeat moisture and chemical migration before they can enter the lamp housing.

The female receptacles in back of the lamp housing are completely sealed. Inside the lamp housing, a solder point connects wires to the backside of the closed female pin receptacles. The wires carry current to the lamp's circuit board by traveling through a waterproof silicone-based sealant that prevents any foreign substance from traveling up the wire path.

Nose box functionality is also critical to the operation of any electrical system. The best nose box designs also feature modular designs, water-resistant plugs as well as gaskets to provide a seal against moisture.

System integrity is the key to winning the battle against corrosion and avoiding CSA problems

“Inspection of all equipment during the winter months and care and maintenance of the vehicle’s electrical system throughout the year are critical,” Johnson says. “Many of our OEM customers recommend that fleets start electrical system maintenance on day one of a vehicle’s service life.”

A standardized planned maintenance (PM) program is also generally recommended, which should include periodic examination of the entire vehicle’s electrical and lighting systems. Every lamp, wire and harness should be visually inspected and any signs of corrosion, cracks, wear areas and punctures noted and corrected immediately, in order to prevent corrosion from beginning and then spreading.

OEMs know that a well-designed, regularly maintained modular system, especially one with LED lamps incorporating SMD technology, will deliver a superior service life.

Optronics’ Bright Ideas Technical Training Program is like boot camp to help fleets avoid CSA issues and uses TMCSuperTech2015 Competition Units

Optronics’ Bright Ideas Technical Training Program is designed to help today’s fleets reduce exposure to CSA violations, by address lighting issues, by gaining a deeper understanding of both operation and regulation.

Optronics was responsible for engineering and manufacturing the lighting and electrical testing boards used in the TMCSuperTech2015 competition held in September of 2015. The same TMCSuperTech testing units are now being used by Optronics to train America’s fleets. Fleets can request on-site training at their convenience and an Optronics trainer will come directly to their facility.

The Bright Ideas Technical Training Program is a comprehensive instructional system that provides a fundamental understanding of electricity, vehicle wiring, lighting connections, installation and basic troubleshooting – all within the context of federal

regulations and CSA requirements. Participants who finish the free course receive a certificate of course completion and a free Bright Ideas Tool Kit.

The curricula includes segments on each of the following:

1. Background on Federal Entities and Regulations
 - a. DOT
 - b. FMVSS 108 (including FMVSS codes)
 - c. NHTSA
 - d. CSA
 - e. SAE lighting standards and their relationship
2. Specific Lighting Regulations for Vehicles
3. Electricity 101
4. Installation and Preventive Maintenance (PM)
5. Added Value of LEDs
6. Tools and Technical Support
7. Lab Support
8. Lighting Requirements Tables and Diagrams

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