

Grounding Solutions for Electric Vehicle Charging Infrastructure

White Paper

How nVent ERICO Copper-Bonded Ground Rods Ensure Safety, Reliability, and Longevity





Introduction

The rapid expansion of the EV market in North America is driving an unprecedented demand for charging infrastructure. While this surge presents significant opportunities, it also introduces critical challenges. The large-scale rollout of EV charging stations presents significant technical hurdles, and installing and maintaining charging stations is not a simple task. The reliability of public fast charging stations remains a hurdle. According to a May 2023 J.D. Power report, **20.8% of EV drivers have experienced malfunctions or failures at public chargers**, contributing to a range of anxiety and concerns about charging availability. This downtime is caused by EV charging station failure, which can have a number of root causes and break down as follow:

- Station connectivity issues (55%)
- Internal station faults or errors (38%)
- Charging connector or cable issues (4%)
- Credit card reader issues (1%)
- Display screen issues (1%)

Grounding and bonding are essential for the safety and security of public fast charging stations. Improper grounding and surge protection can contribute to or cause some of these common EV charging station failure conditions and lead to station downtime. Fast charging stations are bringing high voltage equipment to public places for the people to touch and handle. A faulty ground can cause electricity to flow through unintended paths, including humans, leading to severe injury or death. The National Electric Code (NEC) sets forth requirements for EV charging station grounding to ensure electrical protection is in place to safeguard against these hazards. Many sites, however, lack adequate electrical protection and are at an even greater risk.

nVent ERICO offers comprehensive grounding and bonding solutions that establish best practice electrical protection for public fast charging stations. In this piece we will examine the critical role of grounding and bonding in EV charging infrastructure and demonstrate how proper implementation is essential for preventing electrical shocks, equipment damage, and costly downtime. We will also showcase how nVent ERICO's superior grounding and bonding solutions can address these challenges, providing a foundation for safe, reliable, and compliant EV charging environments.

Why Grounding and Bonding Matter for EV Charging Infrastructure

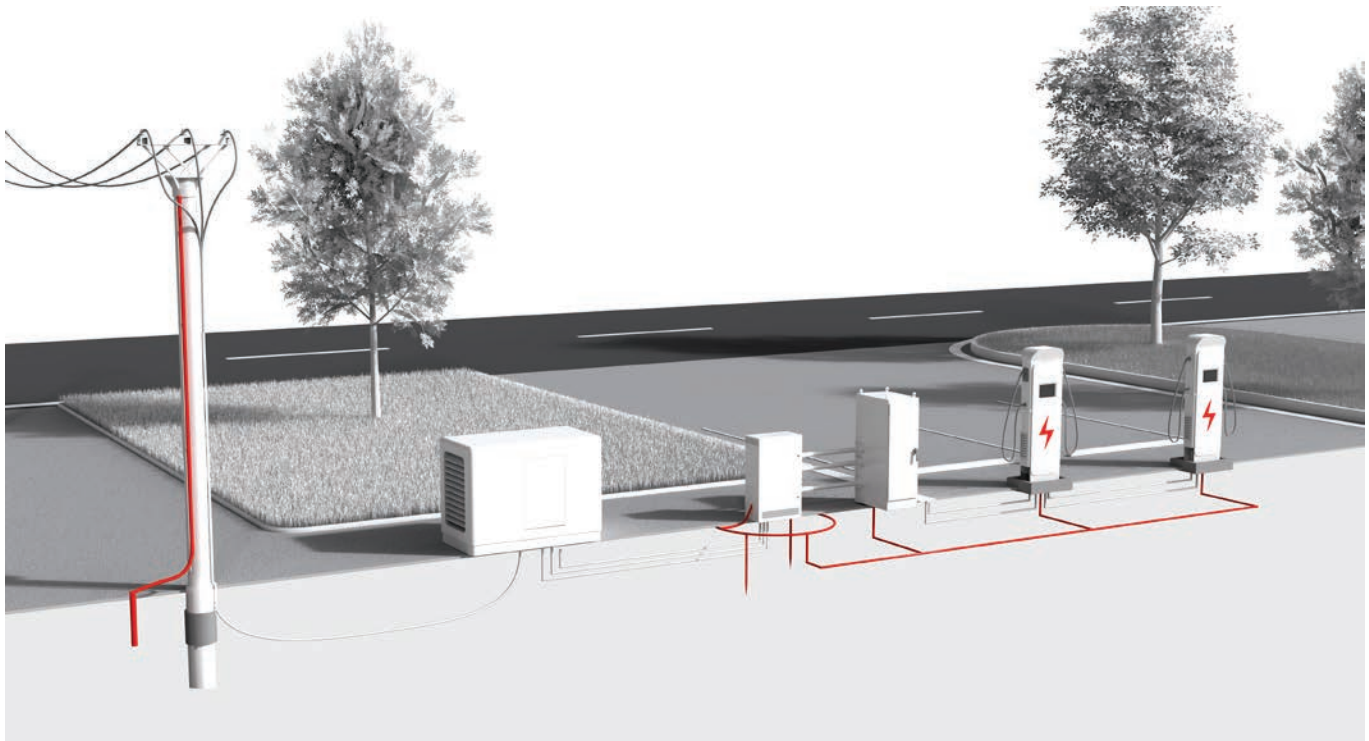
Grounding and bonding are the foundation for safe and reliable EV charging stations. They serve several important functions, such as:

- Protecting the public from electric shock by providing a low impedance path for fault current to flow to the earth.
- Protecting equipment and structures from damage due to lightning strikes, power surges, or short circuits by diverting excess current to the ground.
- Stabilizing the voltage of the system and preventing fluctuations that could affect the performance and lifespan of the charging equipment and the EV batteries.
- Ensuring compliance with the NEC and other relevant codes and standards that regulate the installation and operation of EV charging stations.

Grounding and bonding in EV Charging applications requires careful planning, design, installation, and maintenance of the grounding system, considering various factors such as:

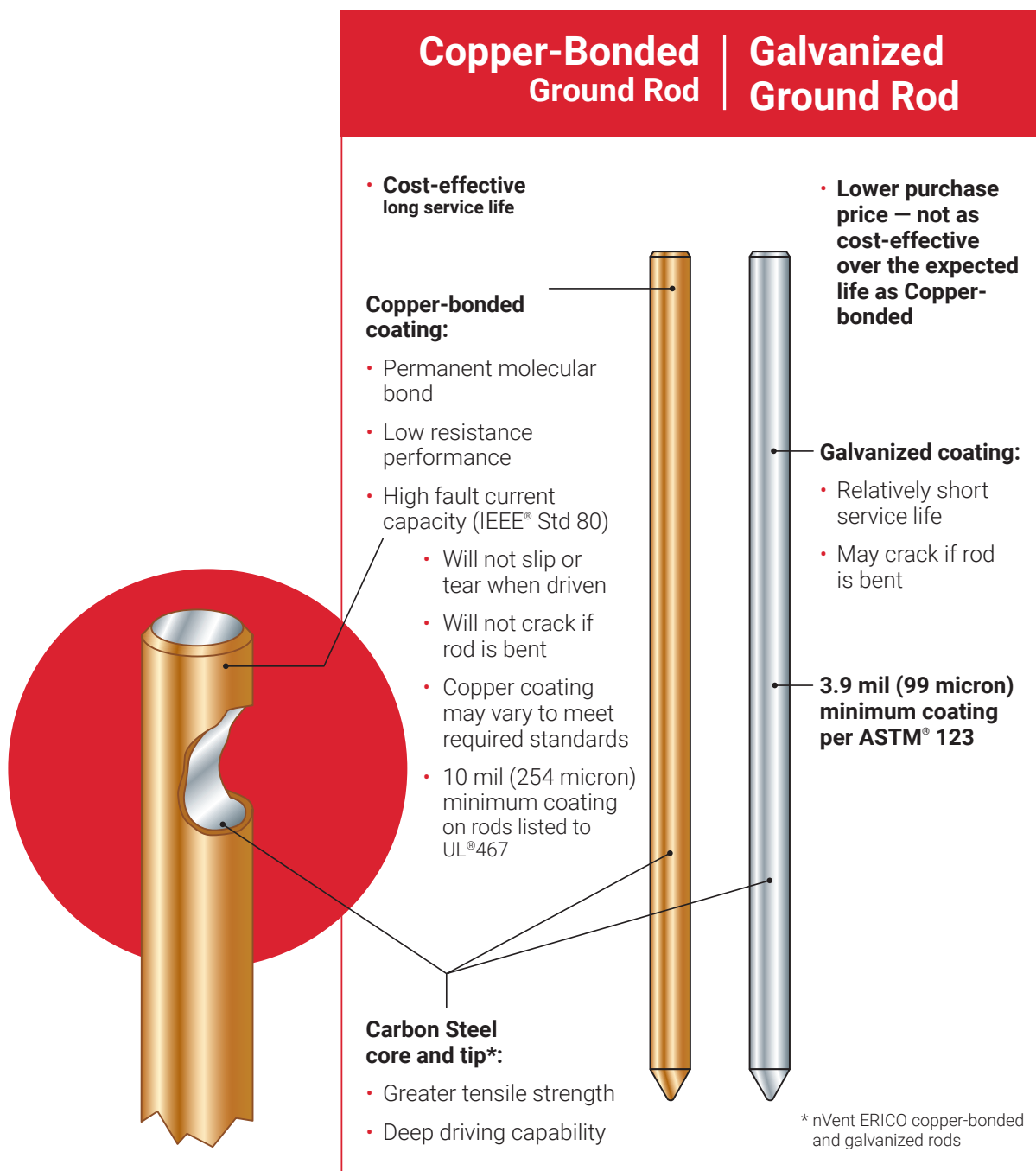
- The type, location, and configuration of the EV charging stations, whether they are AC Level 1, AC Level 2, or DC fast charging, and whether they are standalone, wall-mounted, or integrated with other structures.
- The soil resistivity and moisture content of the site, which affect the impedance and corrosion of the ground electrodes.
- The availability and quality of the existing ground electrode system, which may or may not be adequate for the EV charging stations.
- The environmental conditions and exposure to weather, chemicals, or mechanical stress that could degrade the grounding system over time.
- The potential interference or compatibility issues with other electrical systems or equipment near the EV charging stations.

Given the complexity and diversity of these factors, it is essential to choose a grounding solution that can provide consistent, high-quality, and long-lasting performance. This is where nVent ERICO Copper-Bonded Ground Rods come in.



What Makes nVent ERICO Copper-Bonded Ground Rods Superior

nVent ERICO Copper-Bonded Ground Rods are the premier solution for grounding EV charging stations. Copper-bonded ground rods are a premier choice for grounding systems due to their superior corrosion resistance, longevity, and conductivity compared to materials such as galvanized steel, copper-clad steel, and stainless steel. nVent ERICO Copper-Bonded Ground Rods are made of high-strength steel with a uniform and permanent copper coating that is applied using our proprietary nVent ERICO continuous electro-plating process. This molecular bonding process creates a stronger, more durable copper-to-steel interface, ensuring optimal performance and extended service life. This process allows nVent ERICO Copper-Bonded Ground Rods to out-perform inferior copper coated steel ground rods that are manufactured using other methods like rack dipping and jacketing/cladding. nVent ERICO Copper-Bonded Ground Rods offer several advantages over other types of ground rods, such as:



- **Quality and Compliance:** nVent ERICO Copper-Bonded Ground Rods are made in the USA and compliant with UL (Underwriters Laboratory), IEEE (Institute of Electrical and Electronics Engineers), and NEMA (National Electrical Manufacturers Association) standards. They guarantee safety and adhere to stringent quality control.
- **Superior Coating:** nVent ERICO Copper-Bonded Ground Rods have a uniform, high-quality copper coating that resists cracking, peeling, and wrinkling, unlike other methods.



When an nVent ERICO brand of copper-bonded ground rod (top) and a copper-clad rod are subjected to the same pressure load, the inferior copper-clad rod (bottom) develops cracks and creases to the outer sheath. Damage to the rod negatively affects its serviceable life and puts the integrity of the entire electrode at risk.

- **Long-Term Cost Effectiveness:** nVent ERICO Copper-Bonded Ground Rods have superior corrosion resistance and durability due to the copper coating. They have a longer lifespan than galvanized steel rods, which have a shorter lifespan due to corrosion. They also have a lower installation cost than Ufer ground systems, which typically require more materials and labor.



Top ground rod is galvanized steel, $\frac{3}{4}$ " x 10'. Bottom ground rod is copper-bonded, $\frac{5}{8}$ " x 8'. Both ground rods were driven into the soil vertically at the Pecos testing site in Las Vegas, NV in December of 1992. Both ground rods were exhumed from the site in April of 2004. The loss of zinc on the galvanized steel rod resulted in excessive corrosion of the steel. The copper-bonded steel ground rods showed minimal corrosion.



This is a galvanized steel ground rod driven into the ground vertically at the Pawnee testing site in Las Vegas, NV. This ground rod was buried from May of 1992 until March of 2003. The loss of zinc resulted in excessive corrosion of the steel. One area is reduced from a $\frac{3}{4}$ " diameter to approximately a $\frac{1}{4}$ " diameter due to the corrosion. The eventual failure would result in a potentially catastrophic loss of ground.

- **Reliability:** nVent ERICO Copper-Bonded Ground Rods provide reliable grounding for EV charging stations, ensuring safety, and longevity of the stations. They also reduce the risk of liability and downtime due to grounding failures.

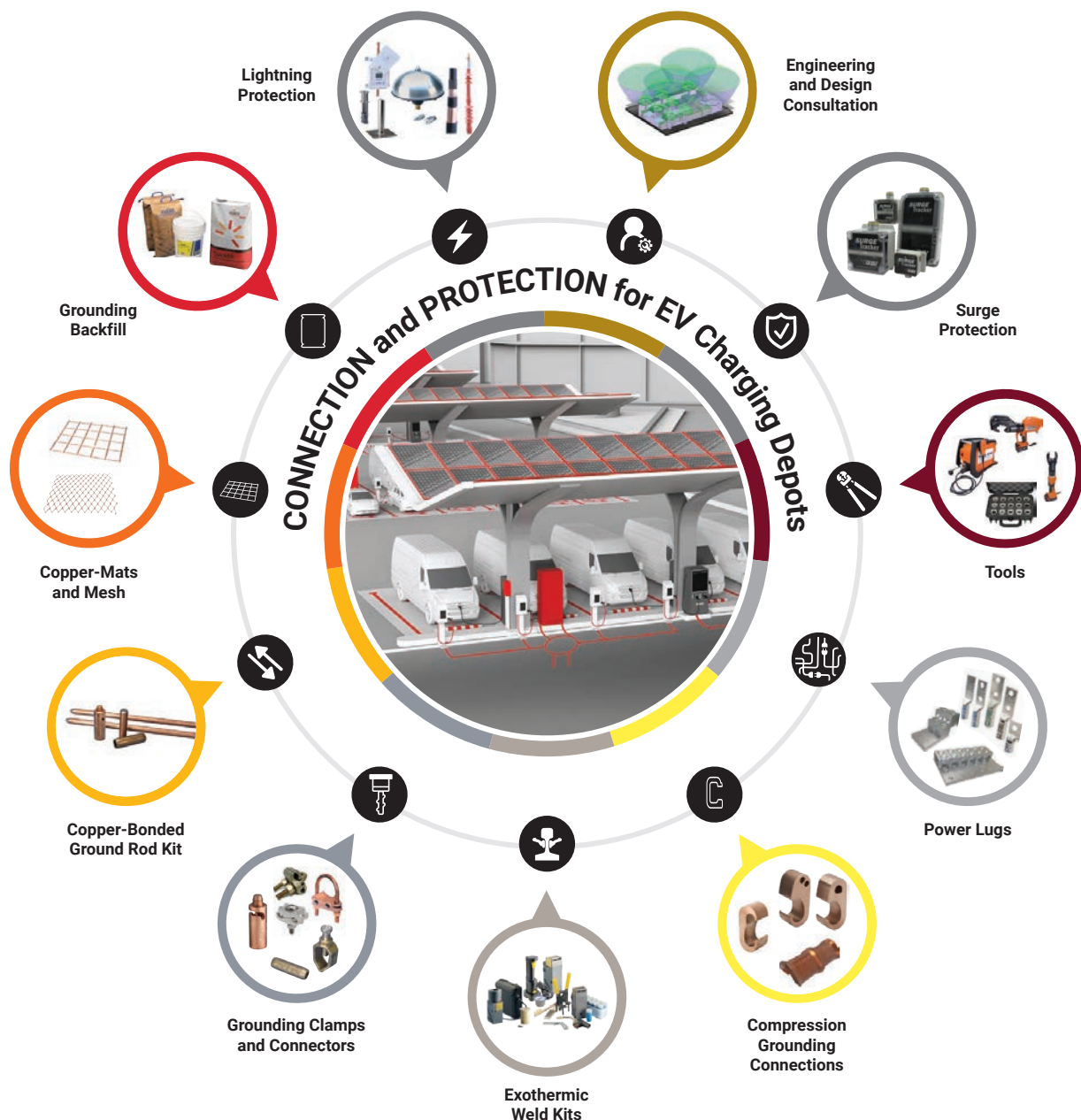
nVent ERICO Copper-Bonded Ground Rods are available in various sizes, lengths, and configurations to suit different applications and site conditions. Copper-Bonded Grounds Rods are installed using various methods, such as driving, drilling, or trenching. Integrated with other nVent ERICO grounding products, including ground enhancement material, ground rod clamps, and bare copper conductors, Copper-Bonded Ground Rods can be part of a comprehensive nVent ERICO grounding system.

How nVent ERICO Provides a Comprehensive Approach to Grounding and Bonding

nVent ERICO is more than just a product supplier. We are a trusted partner for EV charging stakeholders, offering a comprehensive approach to grounding and bonding. We provide:

- **A complete range of NEC-compliant (250.52) grounding products** for EV charging stations, including ground rods, ground enhancement material, ground rod clamps, drive sleeves, bare copper conductors, and more.
- **Expertise and consultation on grounding system design, installation, and maintenance**, based on site-specific conditions and requirements.
- **Customized and pre-configured grounding kits**, made to order and delivered to the site, saving time and hassle.
- **nVent ERICO offers a range of BABA-compliant solutions** that are available for meeting the domestic manufacturing criteria for federal projects.

With nVent ERICO, you can secure your EV charging infrastructure with the best grounding and bonding solutions available. We help you ensure the safety, reliability, and longevity of your stations, while simplifying regulatory compliance and reducing installation and maintenance costs.





nVent ERICO Copper Bonded Ground Rod

Achieve superior ground resistance with durable, long-lasting nVent ERICO copper bonded ground rods.



nVent ERICO Ground Rod Clamps

Connect grounding conductors to ground rods efficiently and reliably with our versatile ground rod clamps.



nVent ERICO Cadweld One Shot

Simplify exothermic welding with our single-use, pre-mixed welding compound for faster installations.



nVent ERICO Lay-in Shear Bolt

Provide mechanical protection for underground cables with our durable lay-in shear bolt.



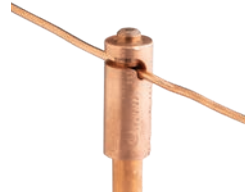
nVent ERICO Ground Enhancement Material

Improve ground conductivity and ground rod surface contact in areas with poor soil conditions.



nVent ERICO Cadweld

Create permanent, reliable electrical connections with nVent ERICO Cadweld Plus exothermic welding system designed to maximum safety, efficiency and connection quality.



nVent ERICO Lay-In Hammerlock Ground Clamp

Ensure secure and long-lasting ground connections with the innovative, irreversible mechanical connection connecting the grounding conductor to the ground rod.



nVent ERICO Compression Couplers

Impart an irreversible connection between two ground rods featuring silicon bronze construction for durability and internal taper for connection integrity.



nVent ERICO Ground Mats and Mesh

Reduce step potential and improve site safety with this comprehensive line of pre-fabricated ground mats, made from wire mesh.



nVent ERICO Compression Grounding

nVent Permaground compression grounding system offers safety and reliability in above-grade and direct burial applications.



nVent ILSCO Surecrimp Aluminum Compression Lugs

High quality, easy-to-install line of compression connectors with features that include range-taking design, and ink marks that clearly display product information and accurate crimp positioning.



nVent ILSCO Cutting and Crimping Tools

Offering a full, versatile line of high quality crimping, cutting and stripping tools for electrical installation.



Surge Protection

Offering a wide range of surge protective devices from the nVent ERICO and SSI (now part of nVent) product lines, critical for protecting electrical equipment.



nVent HOFFMAN Inverter Enclosures

Durable and Reliable NEVI-ready Enclosure for EV Charging Inverters along with climate control solutions.

Conclusion

Grounding and bonding are critical for EV charging infrastructure, as they protect people, equipment, and structures from electrical hazards, ensure system stability and performance, and comply with regulatory standards. nVent ERICO is a dedicated grounding and bonding partner with decades of experience serving renewable energy applications. nVent ERICO provide high quality grounding systems to achieve best-practice electrical protection, ensuring:

- Safe electrical infrastructure
- Security for valuable assets and system uptime
- Simplicity in selection, design, installation and code compliance

We are a trusted partner for EV charging stakeholders, offering a comprehensive approach to grounding and bonding. We provide a complete range of NEC-compliant grounding products, expertise and consultation on grounding system design, installation, and maintenance, customized and pre-configured grounding kits, and BABA-compliant products and MTO ground kits. With nVent ERICO, you can secure your EV charging infrastructure with the best grounding and bonding solutions available.

References

- Voelcker, J. (2023, September 26). *What makes EV charging stations fail? Car and Driver*. <https://www.caranddriver.com/news/a45309960/ev-charging-stations-problems/>
- Ferris, D. (2023, April 12). *Why America's EV chargers keep breaking. Politico*. <https://www.politico.com/news/2023/04/12/america-ev-chargers-keep-breaking-heres-why-00089181>
- Asensio, O., DeLollis, B., & Justice, G. (2024, June 26). *The state of EV charging in America: Harvard research shows chargers 78% reliable and pricing like the 'Wild West'*. *Harvard Business School*. <https://www.hbs.edu/bigs/the-state-of-ev-charging-in-america>



Our powerful portfolio of brands:

CADDY ERICO HOFFMAN ILSCO RAYCHEM SCHROFF