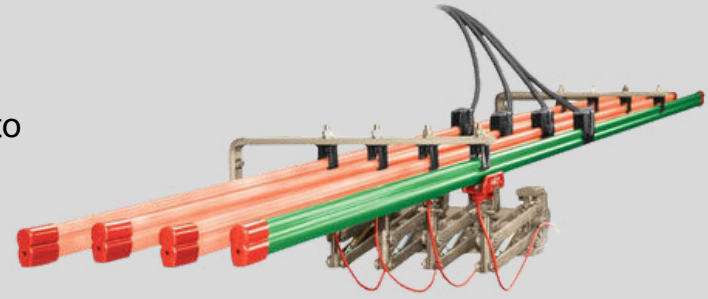
Electrical Grounding of Overhead Cranes and Hoists

As a leader in the crane and hoist industry, ESI prioritizes the safety and efficiency of your operations. One critical aspect of overhead crane systems that warrants attention is proper grounding. Grounding not only safeguards equipment but also protects personnel, ensuring compliance with industry standards and regulations.

Grounding for overhead cranes is governed by national and local electrical codes, specifically the National Electrical Code (NEC) and the Occupational Safety and Health Administration (OSHA) regulations. In 2005, NEC made revisions to their grounding requirements for overhead cranes. They stated that overhead cranes need a separate grounding conductor instead of the previous metal-to-metal connection which was provided by the wheels and track.

What Is Electrical Grounding?

Grounding in electrical systems plays a crucial role in ensuring safety. It provides a direct connection to the earth, serving as a reference point for voltage measurements and offering a safe pathway for electrical current. In typical A/C lines delivering power to homes or businesses, equipment with exposed metal parts is grounded. This grounding ensures that in the event of a fault - where live voltage contacts these surfaces - protective devises such as circuit breakers can act quickly to cut off power, minimizing the risk of harm.



A proper grounding system helps prevent dangerous electrical shocks by ensuring excess energy has a safe path to follow. Without grounding, energy could seek out that path of least resistance, potentially putting individuals like crane operators or maintenance workers at risk. For example, a well-grounded overhead crane system helps protect operators from accidental electrocution or shock during operation or servicing. In electrical power distribution, the Protective Earth (PE) conductor forms an essential part of this safety system, providing vital protection against electrical faults.

NEC Article 610.61 Revisions

The NEC 610.61 code article now states that a three bar or wire system is out of code and that a fourth conductor is necessary for grounding. In 2002, the Crane Manufacturers Association of America (CMAA) proposed a change to overhead crane grounding standards, which was later implemented in 2005. This update introduced the recommendation of a fourth conductor bar for grounding in their specifications for various crane types, including top running bridge and gantry cranes (Specification #70) and single girder cranes (Specification #74).

Before, the NEC allowed metal wheels on metal tracks but now this method is inadequate and emphasizes the need for a separate bonding conductor to ensure effective grounding, as dirt and debris could hinder contact.

The CMAA highlights that a fourth rail would:

- improve variable frequency drive performance
- reduce drive faults by dissipating excess current
- enhance safety by protecting operators from accidental electrocution.

The updated **NEC Section 610.61** states:

"All exposed non-current carrying metal parts of cranes, monorail hoists, hoists, and accessories, including pendant controls, shall be bonded either by mechanical connections or bonding jumpers, where applicable, so that the entire crane or hoist is a ground-fault current path as required or permitted by Article 250, Parts V and VII.

Moving parts, other than removable accessories, or attachments that have metal-to-metal bearing surfaces, shall be considered to be electrically connected to each other through bearing surfaces for grounding purposes. The trolley frame and bridge frame shall not be considered as electrically grounded through the bridge and trolley wheels and its respective tracks. A separate bonding conductor shall be provided.

These requirements are not intended to allow the trolley frame or bridge frame to serve as the EGC for electrical equipment on a crane. The EGCs that are run with the circuit conductors are required to be one of the types described in 250.118. Metal-to-metal bearing surfaces of moving parts are considered to be a suitable grounding and bonding connection. However, the bridge and trolley wheel contact with their tracks is not permitted to be used as a reliable grounding and bonding connection. Because dirt or other foreign surfaces could impede the effectiveness of the wheel-to-track contact as a reliable grounding and bonding connection, the bridge and trolley frames of an electric crane are required to be bonded through the use of a separate conductor."

OSHA Requirements:

OSHA provided answers to general grounding overhead crane requirements:

Question 1: With respect to electrically operated overhead cranes and hoists, does OSHA require the equipment to have a connection to ground via separate equipment grounding conductor and prohibit the path to ground from going through the wheel bearings lubrication, and the wheel-to-rail contact surface?

OSHA Response: OSHA's standard does not specify this requirement. However, the crane equipment you discuss in your request travels on wheels in contact with supporting rails. Where a separate conductor rail is not provided as the low-impedance path for ground-fault current, the grounding path for the crane equipment, whether through the wheel bearings and lubrication and through the wheel-to-rail contact surface or otherwise, must meet the requirements of OSHA's standards. OSHA requires the frames and tracks of electrically operated cranes and hoists to be grounded such that "[t]he path to ground from circuits, equipment, and enclosures shall be permanent, continuous, and effective." 29 CFR 1910.304(g)(5) and (g)(7).[1]

Therefore, to the extent that the employer ensures that the path to ground through the wheel will be "permanent, continuous, and effective," the employer may ground the crane through the wheels. However, OSHA notes that there are a number of substances that could be initially present, or develop through usage, that could be potentially prevent the ground path through the wheels from being "permanent, continuous, and effective." These insulating materials include, but are limited to, paint, rust, dirt accumulation, and even animal nests and carcasses. OSHA further cautions employers that the most recent editions of the National Electrical Code (NEC) (2005, 2008, and 2011) include a general prohibition on equipment through the bridge and trolley wheels.[2]

Question 2: Does OSHA have any grandfather-type exceptions regarding the grounding requirements for overhead cranes and hoists?

OSHA Response: No. Although there is a grandfather provision in 29 CFR 1910.179(b)(2),[3] it applies to the design of overhead and gantry crane equipment and not to how that equipment is installed and c01mected at a facility. According to 29 CFR 1910.179(g)(l)(i), all crane installations must comply with 29 CFR Part 1910 SubpartS, which contains grounding requirements in §§1910.304(g)(5) and (g)(7). Existing crane equipment is not grandfathered (excepted) from these requirements based on the date the equipment was designed or installed. See § 1910.302(b)(1) ("The following requirements apply to all electrical installations and utilization equipment, regardless of when they were designed or installed:*** §1910.304(g)(5)-Grounding-Grounding path ... § 191 0.3 04(g)(7)- Grounding-Non Electrical equipment.").

Ensuring Compliance and Safety

At Engineered Systems, we prioritize safety and compliance in overhead crane operations. To meet NEC 610.61 requirements, we recommend two primary approaches:

1. **Fourth Ground Bar Installation**
   This method involves adding a dedicated grounding conductor to your existing system. Our experienced technicians can often integrate this solution efficiently, minimizing disruption to your operations.

2. **Positive Collector Shoe Implementation**
   For facilities where downtime is a critical concern, there is an alternative that adheres to both NEC and OSHA standards. This approach involves mounting a specialized collector shoe on the runway rail, ensuring consistent grounding without relying solely on wheel contact.

Key Considerations:

- Verify proper integration with your facility's ground grid
- Ensure direct rail-to-girder contact
- Confirm secure connections at rail joints
- Conduct thorough ground path testing

At Engineered Systems, we are committed to helping you navigate these requirements, ensuring your equipment is both compliant and optimized for performance. Contact us today to create a plan for your overhead crane to meet electrical code compliance.