Resilient connectors ready for duty

How Tin Zinc J plating tops cadmium for electrical connectors in military operations

According to Cocoon, the US Department of Defense spends approximately $20 billion on corrosion maintenance annually. Electrical connectors are not immune to the effects of corrosion. As these are responsible for providing power, signal and data to military systems and heavy industrial vehicles, a great deal of research has gone into making them corrosion-resistant. Here, Achim Raad, Product Manager at defence and industrial connector manufacturer ITT Cannon, whose products are distributed by PEI-Genesis, discusses how Tin Zinc J plating provides military-grade corrosion resistance while adhering to environmental regulations.

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Both military ground vehicles deployed in desert operations and heavy, off-road and construction vehicles face extreme environmental challenges, including scorching daytime temperatures, cold nights and abrasive sand that can degrade their components. Shifting to coastal areas introduces high humidity and salt air, accelerating corrosion, especially on electrical connectors critical for operation.

For decades the defence and heavy industrial sectors have relied on connector plating technologies to ensure the durability and reliability of electronic and communication devices in harsh environments. Historically, olive drab cadmium plating has been the standard for the military, prized for its corrosion resistance and electrical conductivity. However, cadmium's environmental and potential health risks prompted a search for safer, yet equally effective alternatives.

According to the scientific paper **Electrodeposition, characterization and corrosion investigations of galvanic tin-zinc layers from pyrophosphate baths**, Tin Zinc alloy deposits are recognised as alternatives to cadmium coatings due to their outstanding corrosion resistance. These coatings combine the barrier protection of tin with the galvanic protection of zinc.

High environmental yet low electrical resistance

Tin Zinc J plating has the ability to withstand harsh environmental conditions, being rated with a corrosion resistance of over 500 hours of static / 5 days of cyclic salt spray endurance as per VG test standards. This resilience ensures that connectors can endure the rigours of extreme weather, exposure to corrosive substances and the wear and tear of rugged terrain, extending the lifespan of military equipment and heavy machinery, while reducing maintenance needs.

The plating also offers high conductivity with a resistance of < 5m ohm. This low resistance ensures a reliable flow of electric current, an essential attribute for maintaining operational integrity in critical communication, navigation and weapon systems.

Military-approved

ITT Cannon's **Tin Zinc J plating** is an ultra-harsh environment formulation that exceeds the VG (German Military) performance requirements of cadmium. In fact, Tin Zinc J plating is the official VG approved 1-to-1 replacement for cadmium.

VG standards, set by the German military, are detailed specifications defining requirements for defence industry products and processes. These standards cover aspects such as environmental resistance, durability and electrical performance, including requirements for connectors used in military applications.

ITT Cannon provides Tin Zinc plated connectors on their VG and commercial equivalent lines.

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High standards

Another benefit of using Tin Zinc J plating over cadmium is that it complies with Restriction of Hazardous Substances (RoHS) and Registration, Evaluation, Authorization and Restriction of Chemicals (REACH) regulations, meaning that it complies to current environmental standards.

Introduced by the EU in 2002, RoHS limits the use of certain hazardous substances in manufacturing, including lead, mercury, hexavalent chromium, and cadmium aiming to safeguard human health and the environment from toxic emissions during disposal and recycling.

REACH, effective from June 1, 2007, broadens this approach by regulating the production and use of chemical substances to mitigate their impact on health and the environment. It mandates the registration of chemicals used or imported into the EU in significant quantities with the European Chemicals Agency, applying not only to the chemicals used in the manufacturing of electrical and electronic equipment but all chemicals, enhancing safety and environmental standards industry-wide.

Compatibility

The backward compatibility of Tin Zinc J plating with existing cadmium and other platings simplifies maintenance and logistical operations. This compatibility ensures that upgrades to Tin Zinc J plating can be implemented without extensive system modifications, reducing logistical complexity. Furthermore, the enhanced durability and reduced maintenance needs of Tin Zinc J plated connectors contribute to greater operational efficiency and readiness.

The ideal connector for tough environments

An important part of choosing the right connector for any application is partnering with a trusted advisor who has a wealth of experience with connectors for your industry. ITT Cannon connectors are distributed by PEI-Genesis, a leading provider of connectors, with extensive expertise in delivering reliable solutions for harsh environments in as little as 48 hours for stocked assemblies.

Military equipment needs to be designed with durability and quick-deployment in mind. Patrols cannot afford equipment failure when in dangerous areas and lives are at stake. Similarly, heavy, off-road and construction vehicles come into daily contact with dust, sand and water. With this in mind, what would be a reliable connector to use in something like a ground vehicle?

Bayonet connectors are highly valued in military operations for their quick and secure locking mechanism, ensuring a reliable connection with a simple twist-and-lock action. This design minimises the risk of disconnection due to vibrations or impacts and is highly resistant to sand and dust, crucial in dynamic and harsh environments.

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Their robustness and ease of use under challenging conditions, such as in field operations where speed and reliability are paramount, make bayonet connectors ideal for maintaining operational integrity in military communications, power supply and electronic systems.

A Tin Zinc plated bayonet connector would therefore provide a highly conductive, corrosion resistant, environmentally safe, secure and quick connection for a ground vehicle, adding to its operational readiness.

To find out more about military requirements for electrical connectors and advice on selecting the right connector for the job, contact your **local sales office**.