



WHY PLATING AND SEALING ARE CRITICAL TO HEAVY EQUIPMENT RELIABILITY

PROTECTING ELECTRICAL PERFORMANCE AND OPERATOR SAFETY IN HARSH OPERATING ENVIRONMENTS



THE HARSH ENVIRONMENT CHALLENGE

Heavy equipment connectors must withstand conditions far beyond those encountered in conventional industrial applications, such as:

- Continuous exposure to moisture, rain, snow, and occasional submersion
- Salt, hydraulic fluid, fuel, and other corrosive chemicals
- Abrasive dust, mud, sand, and road debris
- Constant shock and vibration
- High-pressure, high temperature washdowns
- Electromagnetic interference (EMI) and wide thermal swings (Source: [ITT Cannon Application Note](#); [Cadmium Replacement Blog](#); [Position Paper](#))

Aluminum remains the most widely used connector shell material due to its strength-to-weight ratio and cost efficiency. However, untreated aluminum corrodes rapidly in aggressive environments. As a result, protective plating is not optional. It is essential.

Heavy equipment whether used in construction, refuse collection, agriculture, mining, military transport, or off-road industrial applications operates in some of the most demanding environmental conditions imaginable. These machines are constantly exposed to high levels of shock and **vibration, corrosive chemicals, abrasive dust, moisture, high-pressure washdowns, and extreme temperatures**. In such conditions, electrical and data connectivity often represent a critical point of vulnerability. A single compromised connector can lead to unplanned downtime, safety hazards, regulatory noncompliance, and costly equipment failures.

To ensure consistent performance and long-term operational reliability, two engineering disciplines play a disproportionate role in system success: **protective plating** on metal connector shells and **environmental sealing** of the interconnect interface. Together, these technologies protect against corrosion, moisture ingress, contamination, and electrical degradation. Safeguarding the critical power and signal pathways, modern heavy equipment depends on.

WHY PLATING MATTERS: CORROSION RESISTANCE, ELECTRICAL PERFORMANCE, AND REGULATORY COMPLIANCE

For decades, cadmium plating was the standard solution in harsh environment connectors, offering a unique combination of corrosion resistance, conductivity, and wear performance. Cadmium also provides excellent salt spray resistance, effective EMI shielding, and non-reflective finishes, making it a preferred choice in military, transportation, and heavy industrial equipment.

Today, however, evolving global regulations are driving a transition away from cadmium-based solutions to environmentally compliant alternatives. Key factors include REACH legislation which restricts the use of Hexavalent Chromium (Chrome VI), a critical element in traditional cadmium plating.

- **RoHS** directives and sustainability initiatives require the reduction or elimination of toxic materials and substances.
- **Wash-down-intensive applications**, such as refuse vehicles and heavy equipment, where cadmium shedding presents increased environmental risk.

In response, the interconnect industry has developed high-performance, cadmium-free plating systems that maintain durability while meeting global compliance requirements.

Tin Zinc - Including ITT Cannon's New Tin Zinc J Plating

- Up to 500 hours static or five-day cyclic salt spray resistance
- Excellent EMI shielding performance
- Highly electrical conductivity (<5 mΩ)
- Proven performance in military and ultra-harsh environments
- Qualification per the German Army VG standards

Zinc Nickel - ITT Cannon's Proprietary Blue Generation[®] Zinc Nickel (ZnNi) Plating

- 500 hours salt spray resistance
- High shielding performance
- Ideal for construction, transportation equipment, and off-road vehicles

Zinc Cobalt (ZnCo) & Epoxyurethanic Varnish Solutions

- Strong corrosion resistance for outdoor environments
- ZnCo provides higher EMI performance than varnish platings
- Available in non-reflective finishes colors for defense and industrial applications

These advanced plating options enable heavy equipment manufacturers to achieve long service life and reliable electrical performance while aligning with evolving environmental regulations.



WHY SEALING MATTERS: PROTECTION AGAINST MOISTURE INGRESS CONTAMINANTS & ELECTRICAL FAILURE

While plating protects the connector shell, environmental sealing protects the electrical interface itself. In modern heavy equipment, IP-rated sealing is increasingly mandatory to prevent:

- Liquid ingress during rain exposure, flooding, or pressure washing
- Dust and particulate intrusion that degrade contact performance
- Oil, fuel, and chemical intrusion that cause electrical shorts
- Long-term performance drift in sensors, control units, and telematics systems

Critical Sealing Leverages

- **IP67** sealing ensures dust-tight performance and temporary submersion resistance.
- **IP69K** is essential for equipment regularly subjected to **high-pressure and high temperature washdowns**.

Applications such as refuse vehicles, engine control units, telematics modules, lighting systems, and safety electronics rely on sealed interconnects to ensure uninterrupted operation.

Field data consistently shows that insufficient sealing remains one of the leading root causes of electrical failure in heavy machinery.

CASE EXAMPLE

SEALED & PLATED CONNECTORS IN REFUSE TRUCK CONTROL SYSTEMS

When updated safety regulations required a refuse truck manufacturer to redesign its electrical architecture, existing connector solutions proved inadequate. Legacy connectors lacked the required pin density, sealing performance, and long-term durability for the application.

ITT Cannon engineered *a customized CA Bayonet connector solution* featuring:

- A purposed-designed PG-threaded sealing adapter
- A custom engineered backshell compatible with existing harnesses
- Enhanced environmental sealing for washdowns, vibration, and debris exposure
- Full compliance with updated safety and regulatory requirements

The solution **passed rigorous waterproof and vibration testing**, avoided costly system redesign, and delivered long-term reliability for a harsh, safety critical application.



THE PATH FORWARD

Sustainable Platings and Advanced Sealing for Future Platforms

Heavy equipment manufacturers must prepare for an operating landscape in which:

- Chrome VI restrictions continue to tighten, and within military and VG applications manufacturers face a progressively shrinking addressable market for cadmium-plated solutions
- Digitalization increases the number of exposed electrical interfaces Equipment must operate reliably despite harsher conditions and longer service expectations
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At the same time, alternative surface finishes and base materials are expanding the design toolbox beyond traditional plating over aluminum where higher performance is required. Options such as hard anodization on aluminum, stainless steel shells, and marine bronze shells provide enhanced abrasion resistance, superior corrosion protection, and improved durability in demanding environments. Hard anodization in particular can achieve 1000+ hours salt spray performance while delivering excellent dielectric insulation and surface hardness.

ITT Cannon's continued investment in plating research, advanced sealing technologies, and application-specific connector design provides manufacturers with compliant, future-ready solutions that do not compromise performance.

CONCLUSION

In heavy duty machinery, reliability is inseparable from the integrity of every electrical connection.

Protective plating guards against corrosion, EMI, and surface degradation, while **robust environmental sealing** prevents moisture and contaminants from compromising power and signal integrity.

Together, they determine whether a machine functions safely and consistently or fails prematurely in the field.

For organizations designing or upgrading heavy equipment platforms, selecting properly plated and sealed connectors is not merely a component-level decision. It is a foundational engineering decision that directly impacts system safety, regulatory compliance, lifecycle cost, and fleet performance.

With its portfolio of advanced plating alternatives, high-performance sealed connectors and custom engineering expertise, ITT Cannon stands ready to help equipment manufacturers build the next generation of durable, sustainable, and high-reliability heavy equipment platforms.

Connect with your ITT Cannon representative today or visit us at ittcannon.com

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