

Harsh Environment Connector Plating: Today and Beyond

Are you prepared for what comes next? Learn more about how REACH legislation is impacting the harsh environment segment, the future of platings that use Chrome VI and how high-performance, environmentally friendly plating alternatives can enhance your connector performance and reliability.

Cadmium: The Harsh Environment Plating of Choice Worldwide

Metal connectors are typically made out of aluminum due to its lightness, low cost, availability and easy machinability. The only problem? Aluminum corrodes quickly. To make up for this shortcoming, connector manufacturers coat aluminum products with protective platings. And for decades, the go-to plating for the harshest environment segments such as military, mining and construction machinery has been cadmium.

Cadmium is hard to beat when it comes to plating performance. It's relatively low cost and easy to manufacture, yet extraordinarily resilient and long-lasting. Even more importantly, it performs very well on multiple harsh environment performance markers: corrosion resistance, conductivity, color and lubricity. It provides the highest levels of salt spray resistance. It's highly conductive. Its olive drab green color is non-reflective. And its low coefficient of friction means it's resistant to wear and tear. But despite cadmium's performance, evolving environmental regulations mean its days are numbered.

Recent Forces Impacting the Connector Plating Market

Environmental legislation has impacted the connectors market before. RoHS 1 and 2 both implemented sweeping changes that restricted the use of hazardous substances. But exemptions were left in place for harsh environment segments where high-performance alternatives didn't exist. Another reason for cadmium's exemption: cadmium-plated connectors are typically secluded in closed electrical systems, so they don't pose a health threat to human beings. But then, in December 2006, the EU put a new piece of legislation in place that went further than both RoHS directives: REACH (Registration, Evaluation, Authorization and Restriction of Chemicals).

Described as "the most complex and most important legislation over the last 20 years that's going to affect industries worldwide," REACH was put in place to protect both human health and the environment without harming the competitiveness of European companies. And while the RoHS directives restrict the content of substances in end products, REACH restricts the use of substances in production processes. That's bad news for cadmium.

The crux of the problem is Chrome VI, a crucial component of cadmium plating. Useful for its mix of performance features such as high electrical conductivity, Chrome VI was designated a substance of very high concern and banned from use, effective September 21, 2017.



Establishing Some Breathing Room

REACH is specifically designed to avoid harming the competitiveness of European companies. Because there is currently no 1:1 technically comparable cadmium alternative, many end customers couldn't switch to an alternative without significantly lowering performance. What's more, cadmium is still the go-to plating for harsh environment applications in the rest of the world — although China and the United States may consider legislation similar to REACH in the near future. So, for the moment, banning Chrome VI and cadmium outright would put European companies at a significant commercial disadvantage.

What does that mean for you? When the REACH restriction went into effect, a handful of connector manufacturers — including ITT — petitioned the European Chemical Agency (ECHA) for special authorization to continue using Chrome VI in the manufacture of connector platings. As a result of the group's petitions, ITT can use Chrome VI in the European-based manufacture of cadmium platings until September 21, 2029. So if you rely on ITT connectors in your harsh environment applications, you can continue to enjoy the highest level of technical performance for the near future.

Assessing Needs and Weighing Options

Despite this respite, harsh environment end equipment manufacturers need to start considering their options now. Introducing new products — especially in the military segment — is always challenging. Standards will need to be changed. New products will need to be approved and tested. It's a costly and time-consuming process that's ideally done just once after a suitable alternative has been identified.

Since there is currently no perfect substitute for cadmium, there have been a variety of market reactions. Some are sticking with cadmium and waiting to see if and when the right technical solution becomes available. Others have been bound by local and national directives and switched to existing alternatives in spite of different performance levels. And still others have decided to unilaterally switch to only 100% Chrome VI-free solutions. There's no one correct answer.

If your organization has been using cadmium-plated products and has decided to explore alternatives, you have options. ITT offers sustainable and cost-effective plating alternatives that enhance the durability, conductivity and performance of a broad range of interconnect solutions — some of which come very close to achieving cadmium's level of performance. These high-performance plating treatments are RoHS- and REACH-compliant, and are designed to meet the needs of an evolving and dynamic marketplace.

The first step in deciding which plating is right for you is taking an honest assessment of what you need from your connectors. Is color a high priority for your application? Or is it more important to have extreme corrosion resistance? Once you've evaluated your needs, it's simply a matter of shortlisting and selecting the corresponding solution. Below are three of our more popular environmentally friendly options:



Blue Generation® Plating

The best technical alternative to Cadmium, ITT Blue Generation® plating is a ruggedized, zinc-nickel-based plating with high conductivity. Designed specifically to prolong the life of connectors in severe environments, it delivers the optimal balance of shielding performance and signal stability. It's also capable of withstanding temperatures ranging from -55° to +125° C.

- **Salt Spray Resistance: 500 hours**
- **Conductivity: High**
- **Color: Grey Blue**



Zinc-Cobalt Plating

Shielded, rugged and ideal for harsh environments, this environmentally friendly plating provides substantial protection for components. It delivers lower corrosion resistance than Blue Generation® plating. But it also provides very high conductivity. It's also available in non-reflective black and olive green and has variants fully approved for use in military applications.

- **Salt Spray Resistance: 200 hours**
- **Conductivity: Very High**
- **Color: Green/Black, non-reflective**



Epoxyurethanic Varnish

An industrial option for outdoor applications that don't require shielding, epoxyurethanic varnish delivers the same level of corrosion resistance as zinc-nickel-based solutions.

- **Salt Spray Resistance: 500 hours**
- **Conductivity: N/A**
- **Color: Black**

Another option is to opt out of aluminum connectors entirely in favor of marine bronze or stainless steel. Connectors made from these materials don't require plating. But there are significant weight and cost tradeoffs.

Where Will We Be in 2029?

For the moment, cadmium is truly a one-of-a-kind plating. And while industry leaders like ITT are constantly innovating to develop safe, sustainable and durable plating alternatives, there's no guarantee that there will be an exact replacement when the extension to use Chrome VI ends.

Depending on your needs today, a compromise on technical performance may be acceptable. Certain technical features may not be relevant to your end uses. But if switching from cadmium would mean a significant drop in performance, there is another option: partner with a trusted connector company that can evaluate your needs and help you develop a course of action that doesn't feel like a compromise.

At ITT, this type of partnership is achieving big results for our customers. By working side-by-side with you, we're able to anticipate your needs in the moment and provide proactive solutions.

That's not all. As well as making ongoing investments in expanding our onsite plating capability our engineering teams are on the leading edge of future plating research and are aggressively working to develop the plating chemistries of tomorrow.

Whether it's leveraging deep industry knowledge to develop custom connectors or pushing the boundaries of innovation, we are constantly looking for ways to deliver more for our customers.

If you're interested in plating solutions that enhance connector performance and reliability when it matters most, let's talk.



Why ITT

ITT is a focused multi-industrial company that designs and manufactures highly engineered critical components and customized technology solutions. ITT's Cannon brand is a leading global manufacturer of connector products serving international customers in aerospace, defense, medical, industrial and transportation end markets. ITT's Connector business, which also includes the Veam and BIW Connector Systems brand, manufactures and supplies a variety of connectors and interconnects that make it possible to transfer data, signal and power in an increasingly connected world.

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