What is RoHS?

Known for short as ‘RoHS’, 2002/95/EC, the EU Directive on the Restriction of the use of certain Hazardous Substances in Electrical and Electronic Equipment, came into effect on 1st July 2006. This original directive was then replaced by an updated, extended version (‘RoHS Re-cast’), 2011/65/EU, which came into force in January 2013.

RoHS restricts six hazardous substances in Electrical and Electronic Equipment (EEE): Lead, Mercury, Cadmium, Hexavalent Chromium, and two families of Brominated flame retardants: Polybrominated Biphenyls (PBB) and Polybrominated Diphenyl Ethers (PBDE). It also provides for the restriction of additional hazardous substances when scientific evidence is available.

The six named substances are restricted at the homogeneous material level, with the maximum concentration value tolerated for Lead, Mercury, Hexavalent Chromium, PBBs, and PBDEs being 0.1% by weight, and for Cadmium 0.01%.

Why RoHS?

The RoHS Directive was felt to be necessary because of the rapidly increasing volumes of waste electrical and electronic equipment, and the difficulty in treating / recycling it safely. Restricting the hazardous substances used in the manufacturing stage of this equipment makes it easier and safer to dispose of when it reaches the end of its life.

The ‘RoHS Re-cast’ extended the range of EEE falling within the scope of the directive and so by 2019 all EEE placed on the EU market will be compliant, except for that covered by a small number of exemptions. These exemptions are of two types: Time limited exemptions allowing elevated levels of the six restricted substances in very specific applications where there are currently no viable alternatives (eg up to 4% lead is permitted in copper alloys) and non-time limited exemptions for equipment used in specific sectors, two examples being equipment for military use and for use in transport.

Amphenol and RoHS

Much of the Amphenol Ltd’s product portfolio is incorporated into EEE which is covered by an exemption but as some customers do require RoHS compliance, Amphenol aims to be able to provide RoHS compliant products wherever possible. The most common reason for a product not to be compliant is the plating finish. As Cadmium is one of the six restricted substances, any component which is Cadmium plated is not RoHS compliant. There have been significant resources allocated in recent years to developing a RoHS compliant alternative to Cadmium plating, and Black Zinc Nickel is now available to fill this requirement.

Black Zinc Nickel plating is Cadmium free and although Hexavalent Chromium is used in the blackening process, the finished product passes the RoHS Hexavalent Chromium leach test in BS EN 62321, showing the plating to be compliant. Work is already underway to look at alternative ways of processing Zinc Nickel which will not rely on Hexavalent Chromium, to make this Cadmium-free finish even more environmentally friendly.

The future of RoHS

There will be future challenges to meet under RoHS; the scope of EEE covered will continue to expand until 2019, additional substances may be added to the current six and new raw materials will need to be evaluated in anticipation of time-limited exemptions being rescinded. However, with its committed UK-based Engineering, Plating, Assembly and Procurement operations, Amphenol Ltd is in a strong position to meet these challenges.
What is Black Zinc Nickel?

Zinc Nickel is an alloy of 12-15% Nickel, 85-88% Zinc. It is blackened by immersion in a chromate passivate solution, which chemically reacts with the alloy surface forming a layer comprised of various Zinc and Nickel chromates and oxides. This passivate layer provides the desired colour and also greatly enhances the corrosion protection the plating provides to the base metal.

Why Black Zinc Nickel?

After years of research and development into different platings by the Defence and Aviation industries, Zinc Nickel plating is now widely recognised as a viable alternative to the traditionally used but toxic, heavy metal, Cadmium.

During 2011 Amphenol developed a production ready Black Zinc Nickel plating process in the Whitstable, UK facility that satisfied the requirements of MIL-DTL-38999 Series III. It launched Black Zinc Nickel plating on proprietary TV Series connectors in 2012 and gained a number of customer and program approvals. Subsequently, Amphenol has invested in infrastructure and equipment to ensure a fully production ready, repeatable process so that it can provide customers with consistent product performance. Once completed, qualification testing to MIL-DTL-38999 Series III class Z was performed and Amphenol received full approval in June 2013. This fully defined process is now being replicated throughout the Amphenol group to provide local access for our global customer base.

Advantages of Black Zinc Nickel

- **Same thickness as standard plating finishes** - The plating thickness is identical to Cadmium plating meaning that it can be applied to any standard Aluminium connector series without the need for new drawings, tooling or gauges and will still maintain the mechanical integrity of the connector.

- **RoHS Compliance** - The RoHS Directive 2011/65/EU restricts the levels of six substances in electrical and electronic equipment. Amphenol's Black Zinc Nickel plating is compliant with this directive as it does not contain Cadmium, Lead, Mercury, PBBs, or PBDEs. Compliance with Hexavalent Chrome requirements have been verified by an independent test laboratory using the boiling water extraction tests specified in IEC 62321.

- **Performance** - Black Zinc Nickel plating is resistant to corrosion, far out performing other finishes such as Electroless Nickel and Zinc Cobalt and remains functional after 500 hours neutral salt spray exposure. Black Zinc Nickel is also suitable as a plating finish on products in diverse operating environments as it is resistant to common contaminant fluids such as fuels, hydraulic oils, lubricating oils and cleaning fluids. It also meets the requirements for MIL-DTL-38999 Series III connectors including passing severe vibration tests, mechanical shock, EMI shielding, and indirect lightning strike, where 10,000A is passed through the connector metalwork. The plating is rated from -65°C to +175°C and remains unaffected by long-term exposure to temperatures of 175°C. It is electrically conductive, with the mV drop across a Black Zinc Nickel plated mated pair of connectors, from receptacle flange to end of plug, meeting the MIL-DTL-38999 requirement to be less than 2.5mV.

- **Compatibility with Other Plating Finishes** - Depending on the environment, galvanic corrosion can be a potential issue when a connector with one plating finish is mated to one of a different finish, as in a new to legacy system. In general, the larger the potential difference between the two metals, the higher the rate of corrosion. The electrode potential of Zinc Nickel is similar to those of Zinc and Cadmium, which allows Zinc Nickel plated connectors to be mated to legacy Cadmium or Zinc plated connectors.

Applications

Black Zinc Nickel is a versatile plating finish, its non-reflective black finish and RoHS compliant status make it ideal for use in the Civil, Military and Industrial sectors and qualification to MIL-DTL-38999 further diversifies its applications.