Product Data Sheet

Amphenol® Connectors with Zinc Alloy Plating

No. 172-1

Amphenol has been active in the development of an alternative to cadmium plating for approximately ten years. That development process has shown Zinc Alloy to be a good replacement for cadmium in the lower performance connector series such as MIL-C-5015, 97 Series, and some of the MIL-C-26482 Series.

Zinc Alloy, in black or olive drab, has proven to be an optimum alternative to cadmium for the following reasons:

- Ecological advantages over cadmium
- Meets producibility and cost criteria as an alternative to cadmium
- Cosmetically appealing finish to customers looking for connectors that complement the panels to which they are mounted
- Maintains good shell to shell conductivity, allowing for termination of ground sleeves (olive drab only)
- Maintains good electrical bonding of the shell to panel (olive drab only)
- Corrosion resistant properties meet the requirements of MIL-C-5015

Cadmium has long been used as a corrosion resistant plating for aluminum and other metals. Marine environments require a significant amount of corrosion resistance to extend the expected life of the component. The military and aerospace use of olive drab cadmium has driven this plating to become the industry standard.

Environmental concerns surrounding the use of cadmium have forced manufacturers, platers and users to consider less ecologically threatening materials. Several European and Asian countries have barred the import of materials plated with cadmium. Effluent discharge for manufacturers remains a serious problem for platers, as well.

Amphenol's black zinc alloy plating has been proven to be a cost effective and functional alternative to cadmium for non-military connector applications. The development process has continued during production, resulting in an increase in the corrosion resistant properties of the plating. We have increased the corrosion resistance from 48 hours to nearly 200 hours when tested to MIL-STD-1344, Method 1001.1. This superior corrosion resistance was achieved by fine tuning the process and working with the vendor who supplies the basic formula.

The trade-off for the enhanced corrosion resistance is lower shell-to-shell conductivity. The plating process mandates a final treatment that seals the zinc alloy and reduces the conductivity. Connectors identified with the black zinc alloy plating variation (the (025) suffix or the (621) suffix for 97 series) should not be specified when shell-to-shell conductivity or termination of an EMI cable shield is a requirement of the application.

Amphenol meets the growing demand for non-cadmium plated connectors with Zinc Alloy Plated Connectors

What is the basis for determining the conductivity levels in virtually thousands of military and industrial applications? MIL-Spec testing. Most conductivity ratings stem from the basic MIL-specs; MIL-C-5015, MIL-C-26482, MIL-C-38999. The common baseline for this testing is a cadmium plated plug shell with no grounding fingers mated to a cadmium plated receptacle shell. The spec limits for these three common MIL-specs are:

MIL-C-5015 - Conductivity shall not exceed 50 milli-ohms

MIL-C-26482/Series 2 - Conductivity shall not exceed 200 milli-ohms

MIL-C-38999/Series I & II - Conductivity shall not exceed 200 milli-ohms

(All testing conducted at 1 amp driving current)

You will notice the connectors with bayonet style coupling, MIL-C-26482 and MIL-C-38999, have a greater value for conductivity than the MIL-C-5015, a threaded connector. Conductivity is a matter of metal-to-metal contact. The bayonet connectors have stainless steel rivets and ramps with only three points of contact to create a conductivity path. Threaded connectors have multiple points of contact which results in an enhanced conductive path.

Printed in U.S.A. 2/99

Applications requiring shell conductivity or shield termination are becoming more commonplace in the commercial market. Amphenol is well aware of this trend and has developed a plating process for a conductive version of the black zinc alloy plating. Using the same MIL-spec criteria, the following design criteria were tested:

- Shell-to-shell conductivity before and after salt spray
  (All testing conducted at 1 amp driving current)
- Corrosion Resistance
- Durability

The result of the testing shows a maximum of 47 milli-ohms for a mated pair of MIL-C-26482 connectors in shell size 14, and 35 milli-ohms for a mated pair in size 24. These results were obtained from parts with no mating cycles. The general trend is for conductivity to improve after 250 cycles of durability and then gradually decline.

The conductive version for black zinc alloy plating can be procured by identifying the coded part number with the (640) suffix for the 97 Series and the (027) suffix for other series.

Amphenol's objectives for the conductive version of the black zinc alloy plating are simple; consistent, repeatable shell-to-shell conductivity levels which do not exceed 50 milli-ohms for threaded connectors and 200 milli-ohms for bayonet versions when measured over the mated pair of connectors. In other words, conductivity comparable to MIL-spec levels. Any applications requiring a higher level of conductivity than this will require either a mechanical grounding device or a different plating such as nickel.

The industrial market requires a plating that is cost effective, producible, and reasonably corrosion resistant. In addition, the cosmetic aspect of the plating must be considered. Industrial consumers are looking for components that will not detract from the overall appearance of their product. Ideally, the connectors should blend into the panel, and not be glaringly apparent.

Producers of military products are also searching for alternatives to cadmium plating. Cadmium plating has been an item on the agenda of several DESC five-year standardization meetings. Those meetings have not resulted in any significant resolutions or guidelines for the implementation of plating substitutes. The government has not sponsored any formal effort to develop an alternative plating. This has been left to the component manufacturers. Some government contractors have taken the initiative and started their own research into alternatives to cadmium.

SUMMARY

There is a definite growing demand for non-cadmium plating. It is Amphenol's opinion that Zinc Alloy, either in olive drab or black, will meet the requirements of today.

For further information, and assistance on ordering Amphenol® connectors with zinc alloy plating, contact your local Amphenol sales office or:

Amphenol Corporation
Amphenol Aerospace
40 – 60 Delaware Avenue
Sidney, New York 13838-1395
Phone: 607-563-5011
Fax: 607-563-5351
www.amphenol-aerospace.com