STABILANT 22

D.W. ELECTROCHEMICALS LTD.
70 Gibson Drive, Unit 12
Markham, Ontario
L3R 4C2 CANADA
Phone: (905) 508-7500
Email: dwel@stabilant.com

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APPLICATION NOTE

Problems with Tin-plated Electromechanical Contacts

What problems are sometimes encountered in tin-plated contacts?

On occasion, our customers have encountered problems with tin-plated contacts. These are usually of the header type where one or more square male contacts, spaced either on 0.10 or 0.156 inch centers are used to connect stacked PC boards, or mate with wiring harnesses. The problem often occurs only where several conditions exist. One such condition is where design engineers were encouraged to use a connector from a "standard parts" list as part of an inventory-limiting cost-effectiveness program. Often, an engineer will employ a connector with a current rating grossly exceeding of the actual currents involved in the circuit, reasoning, that while it may be over-design, the selection of a lower current connector is not warranted. Here we note that higher-quality plating materials, such as gold are used in most modern small-signal connectors.

Experienced engineers realize that it can be more difficult to design a connector to function properly when carrying signals in the range of 5 picoamps through 10 microamps than it is to design for the 1 amp current range. While the connector may function properly in both the evaluation stages and the initial months of field use, they often encounter problems within the next six months in the field. Contaminant films which would be of little concern for a higher current flow will cause conditions ranging from zero-crossing distortion in AC signals through thin film rectification and/or intermittence.

Sometimes the design of the connector, combined with manufacturing processes and storage/transportation conditions, produce a synergistic effect that will result in field failure. Some tin-plated connectors have a small dimple formed on the inside of the female contact to increase the pressure at the actual point of contact with the male pin. If the forming process involves stretching of the tin plating rather than the use of a coining technique (wherein the tin flows under pressure), micro-cracking may take place in the tin coating. At the lattice structure of tin changes with temperature (including phase changes), stresses can be set-up that will induce the plating to "spall" or flake off the substrate.

This might not occur to a significant extent under normal conditions.

However, we have encountered cases where so simple a thing as the storage or shipping of completed wiring harnesses in kraft paper based corrugated cardboard containers can cause eventual failure: Sulfur compounds (used in paper production) can induce corrosion in the substrate exposed by the cracks. Spalling is increased to the point of causing connector failure within a year of being placed in service.

Can the use of Stabilants solve the problem?

Under most circumstances, the use of Stabilant 22 can increase the MTBF (Mean Time Between Failures) in the field such that an erratic connector may only have to be serviced once in its lifetime (though this can change with exposure to especially corrosive environments). Increases in MTBF of 10x are routine in this application.

The service group can confirm the existence of this tin spalling condition by having a connector's contact pair examined by electron microscope. Not only are the flakes of plating usually readily apparent, but the pattern of corrosion on the exposed substrate will sometimes show where the original cracking of the tin plating occurred, revealing stresses that were placed on the plating by the manufacturing process.

Effective use of Stabilants require that the female connector be treated with sufficient material that the residue of this "metallic dandruff" be purged from the contact area. Even though the substrate material is exposed, the connectors will generally be serviceable upon treatment.

One caveat: Many connectors (e.g., those used on ribbon cables) use insulation-piercing designs as part of the female contact. The service engineer should ensure that the connector problem is not caused by migration of plasticizers from the wire's insulation into the contact between the bared wire and the insulation-piercing part of the contact. With the additional potential for mechanical strain to loosen these connections, this adds to issues with the actual male-female contact pair as a source of trouble. These are easily treated with Stabilant 22A.

NATO CAGE/Supplier Code 38948

15ml Stabilant 22 (Concentrate), NATO Part # 5999-21-909-9981

15ml Stabilant 22A (Isopropanol Diluted), NATO Part # 5999-21-900-6937

15ml Stabilant 22E (Ethanol Diluted), NATO Part # 5999-21-909-9984

The Stabilants are patented. Because the patents cover contacts treated with the material a Point-of-Sale license is granted with each sale of the material.

SAFETY DATA SHEETS ARE AVAILABLE ON REQUEST

NOTICE

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