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APPLICATION NOTE

Stabilant 22 Use with Gold-plating and Solder Alloys

Introducing Stabilant 22

Stabilant 22 is an initially nonconductive block polymer which when used in a thin film between metal contacts becomes conductive under the effect of an electrical field. This occurs at an electric field gradient such that the material will remain nonconductive between adjacent contacts in a multiple pin environment. In addition, Stabilant 22 exhibits surfactant action as well as lubrication ability, providing a single component resident solution to virtually all contact problems.

When applied to electromechanical contacts, Stabilant 22 provides the connection reliability of a soldered joint without bonding the contact surfaces together.

In this Application Note, we outline the benefits of Stabilant 22 treatment of various contact materials, from solder coated to gold plated, with precautions for different materials in combination. Some early practical service situations are also described.

Problems in connectors with gold-plated contacts mated to solder-plated parts

Connectors designed with *low contact to contact pressure* are not recommended where high ambient temperature or humidity are encountered. In the design of good quality connectors, sufficient pressure is maintained at each point of contact to exclude the entry of oxygen and moisture. Contact pressure in the range of 500 to 800 lb/in² will usually keep the junction in good order.

The inherent concerns with corrosion and mechanical wear are especially troublesome where dissimilar plating metals are combined. This includes gold plated contacts mated to solder alloy plated contacts. These situations may be encountered in older systems; even the use of Stabilant 22 may not allow optimal connection service life in such an arrangement.

Solder plating itself is prone to corrosion, especially with high humidity and temperature – it is common to see hard black deposits of lead and tin oxides that lead to high resistance connections. Some corrosion (by creating a semiconducting barrier) produces a rectifying effect, causing signal distortion. This is worsened by combining different metals, so the better solution is the use of like materials (whether gold or solder plated) for both contacts.

When applied to well designed connectors, Stabilant 22 treatment provides enhanced protection from contamination and wear, resulting in contact reliability over a longer period of time. The benefit when used in mixed plating situations is more modest.

Chemicals used to inhibit the formation of oxides

Stabilant 22 is a different approach to the problems of corrosion / oxidation. There are contact treatments on the market that aim to remove or suppress oxidation. Some are basically a sophisticated cleaning solution, not guaranteed to maintain good contact in the long term. Corrosion inhibitors and complex dielectric greases likewise may have a limited service life and require care in selection.

Stabilant treatment does not chemically reduce oxides but prevents them from forming by creating a seal around the actual contact area. It is so stable that one treatment can last many years.

General notes about the use of dissimilar metals

Good engineering practice for connectors requires contacts made with corrosion resistant materials and avoids pairing those with *grossly* different galvanic potentials. Reactivity (measured as electronegativity or half-cell potentials) predicts the likelihood of "galvanic corrosion". This is a continuing problem when humidity is present, creating the effect of a short-circuited battery within a contact pair.

An extreme example of this would be a pairing of gold and aluminum with inadequate contact pressure. Here, with oxygen and moisture present in the air, the aluminum even more certain to oxidize than with both parts made of aluminum.

Corrosion products like oxides, sulfides, carbonates, etc. are usually insulators that interrupt a connection. Even poorly insulating types can exhibit semiconductor effects at the metal / oxide junction, creating unwanted rectifying effects. One symptom of this is demodulation of any stray RF signals present on the lines. Digital signals may experience poor rise time, which can show up as a computer crash or chaotic behaviour of any peripheral using an affected connector.

Stabilant 22 treatment is especially helpful when one must deal with poor connector designs. It reduces corrosion by keeping humidity and oxygen from creating the unwanted electrochemical action and reduces mechanical wear in all cases.

Service experiences in the early days of personal computers

- 1) Many of the first enhancement boards made to fit the Apple Macintosh™ computer used a connector clip which snapped down over the 68000 microprocessor chip on the main board. The initial design had gold plated contacts which exerted only a low pressure over a fairly large area of the corresponding solder-alloy plated IC contact.

The design of that clip, together with the shielding effect of the board to which it was attached, created a higher temperature environment in the vicinity of the contacts. Additionally, the clip's molded polycarbonate housing would absorb small amounts of moisture when cool, releasing it when heated up. It was not unusual to find that the enhancement board became erratic after two to three weeks of operation.

Examination of the hard black film that formed at the junction of the two metals revealed that it was substantially composed of oxides of tin and lead. A redesign of the clips did significantly reduce the failure rate; nevertheless, a number of companies servicing this equipment still found it prudent to apply Stabilant 22 to the contacts, and they reported that this took care of the marginal cases.

- 2) Connector problems with older graphic accelerator boards were addressed with the application of Stabilant 22. This alone was found to increase the Mean Time Between Failures from a two week period to about seven weeks. Even this magnitude of improvement in MTBF was not sufficient in the application, and additional contact cleaning was necessary before applying Stabilant.

On the basis of solving similar problems with other types of connectors, our recommendation was that the gold plate be changed to solder alloy plate, and that the contact pressure be increased either by the use of a thicker contact stock or the use of a small dome protrusion on the contact. We found that under these circumstances, the use of Stabilant 22 on a solder to solder contact pairing, resulted in a MTBF of years rather than weeks.

NATO CAGE/Supplier Code 38948

5mL Stabilant 22 (Concentrate), NATO Stock Number 5999-20-002-1112

15mL Stabilant 22 (Concentrate), NATO Stock Number 5999-21-909-9981

15mL Stabilant 22A (Isopropanol Diluted), NATO Stock Number 5999-21-900-6937

15mL Stabilant 22E (Ethanol Diluted), NATO Stock Number 5999-21-909-9984

Stabilant products 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

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