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APPLICATION NOTE

Stabilant 22 in Aviation: Avionics and Navigation

Introducing Stabilant 22

Stabilant 22 is an initially non-conductive liquid 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 first address the use of Stabilant 22 in the aviation field, with an emphasis on avionics/navigation systems. Later, a few common questions are answered about the product - for a more complete list, please see Application Note #1.

Applications for Stabilant 22 in aviation

As any avionics technician can well attest, one of the major problems in avionics has been that equipment that performs flawlessly in the service bench often fails when re-installed in the aircraft. This usually involves connector or wiring harness failures, a particularly difficult thing to service for the technician who is faced with working in hard-to-reach places, and expensive to the aircraft operator because the aircraft is tied up during this service. Stabilant 22 has become the product of choice for many organizations in the industry to mitigate these problems.

The use of computer chips and other integrated circuits has enabled avionic equipment manufacturers to introduce new features, while reducing the size of the equipment, power draw, and installations package count. Due to complexity, these improvements have not been totally problem free.

While some of the connector problems have been moved from the aircraft harness into the equipment itself, the complexity of the circuitry together with the very low current levels in the contacts resulted in increased connector-related service problems.

Microprocessors in avionics have allowed implementation of many new features simply by updating the internal software. In the years before flash memories entered widespread use, replaceable (socketed) ROM/EPROM IC's were used, making this type of system more prone to "crashing" because of socket contact problems. The older Loran-C receivers, for example required EPROM-based databases that would be updated periodically in order to accommodate new frequencies, or other airport or nav-aid information. Even in the 21st century, with GPS and satellite navigation taking over, Loran-C systems are maintained as a backup; some receivers were still on sale as of 2023.

In the environment of vibration and cyclic pressure/temperature changes, IC and memory module sockets, as with most aviation connectors, are much more prone to contaminant penetration than those in stationary installations.

Stabilant products have been used since the 1980's to overcome these problems. The opportunity to increase contact reliability in this environment is a result of several factors. Vibrations cause small relative movements of components, degrading contact surfaces due to "stiction" effects and creeping corrosion or contaminant films. These compounding effects increase resistance and lead to contact failure. Even before an obvious failure occurs, these produce intermittent troubles, including microphonics - the introduction of spurious signals directly from the vibrations. Some corrosion by-products can also cause rectification effects, which can alter waveforms, change critical timings, and make the equipment prone to RF interference.

Stabilant 22 replaces older contact lubricants. It does not suffer from varnishing due to catalytic cross-linking as would those with unsaturated oils. It provides a longer lasting solution, including chemical stability and a surfactant property that keeps existing contaminants from adhering to the contact surfaces. The electrically active properties of the product counter the rectification effects commonly produced by penetration corrosion films. And, of course, the Stabilant film surrounding the contact interface prevents external contaminants from entering the interstices of the contacts.

Stabilant 22 thus substantially improves the reliability of multiple (interdependent) package installations as well as improve the reliability of single package units. With the increasing costs of avionics service the savings can be considerable.

In instrument landing systems, Stabilant treatment has been proven to cure most connector related problems, especially where the operating environment is less than ideal. This is also true of VOR's, VORTAC's, NDB's and marine beacons. Often these navigational aids are located in remote, difficult-to-access places where a major part of the maintenance time is just getting to and from the site. Added to these costs is the work of verifying function and calibration of the repaired systems.

Many navigational aids are more likely to fail under severe weather conditions, which is often when they are needed most. When connections are less than perfect, the system more is more susceptible to RF interference and the electromagnetic pulse effects of lightning. We have even been told that some stations are applying Stabilant 22 to the pins as well as to the finger stock contacts used on transmitting tubes in order to reduce parasitics.

With the increasing sophistication of the equipment, the power levels of the individual circuits have been substantially reduced, conserving energy, and minimizing heat dissipation requirements. This involves components operating at much lower current levels, and thin film contamination effects are proportionally more important in determining reliability of the connections.

The number of connections in most systems has also increased substantially. And while microprocessor control is now making it easier to perform self-checks on some of the new equipment, increasing connector pin counts have made the same equipment more sensitive to all types of connector problems. Stabilant 22 treatment mitigates the well known effect of increased complexity leading to increased failure rate.

In what forms is Stabilant available?

Stabilant 22 is provided as a concentrate (simply 'Stabilant 22'), as an alcohol diluted form called Stabilant 22A (with isopropanol) or as Stabilant 22E (diluted with ethanol). It is packaged in 5mL, 50mL, 100mL, 250mL, 500mL and 1 Litre containers. The Stabilant 22A 15mL Service Kit, including the 15mL bottle, microbrush applicators and instructions, is our most popular product.

An additional packaging form, Stabilant 22S, is available for industrial/bulk users. Here the concentrate occupies one-fifth the volume of an otherwise empty container, allowing end users to add their own diluent. This saves the added costs of shipping the alcohol, as well as allowing the choice of an alternate diluent such as one of the other solvents used in electronics.

What is the difference in the use of Stabilant 22 vs. Stabilant 22A?

The concentrate, Stabilant 22 is most useful where the connections are out in the open such as exposed RF connectors. Where the connections are not too easy to get at or where the user wishes to apply the material to something such as a socketed IC (without removing the IC from its socket) it is easier to use the alcohol diluted form, Stabilant 22A. The isopropyl alcohol diluent serves only to carry the concentrate into the connector.

What is the best way to apply Stabilant 22 to contacts?

The 5mL, 15mL and 50 mL dropper bottles allow Stabilant 22 or 22A to be applied directly to such components as socketed ICs, switches, connectors, etc. The microbrushes supplied in our Service Kits can be used to apply it to card edge connectors. Cards can also have their edge connectors dipped into the dilute material. Some users have applied Stabilant with a syrette type dispenser.

Very little is needed – a final film thickness of from 1 to 2 mils is all that is necessary (mils referring to 1/1000 of an inch or .0254 mm) - just enough to fill up the interstices between the contact's faces. When using Stabilant 22A/22E, you'll have to use enough so that once the isopropyl alcohol or ethanol evaporates, the desired 1 to 2 mil film of Stabilant 22 remains.

How can I be sure that Stabilant 22 works?

Stabilant 22 initially passed a number of stringent field tests before being issued a NATO supply code number. It has been in use by aircraft service organizations for many years and has been TSO'd by a major avionics manufacturer. Even audio service techs and consumers found the material easy to use and its results impressive. However, we still feel that the best way to find out just how well it works is to try it out! That's why we have samples available. Almost every service shop or manufacturer has equipment available where the switches or connectors have become erratic over the years. Use Stabilant 22A on them for a quick turnaround test or use the material in field service and satisfy yourself.

Does the action of Stabilant 22 deteriorate with age?

Stabilant products have been in some field applications for over twelve years (as of this writing) without showing any sign of reduced effectiveness. Our published shelf life is 15 years, but customers report good results with Stabilant products after 20+ years on hand! Stabilant 22 features low reactivity, eliminating most causes of deterioration or either the material itself or of components to which it is applied. The high molecular weight and very low vapor pressure and so is not prone to evaporation. Unless removed by cleaning, it will probably outlast the usefulness of the electronic equipment on which it is used.

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

NOTICE

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