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APPLICATION NOTE

Reduction of 'Electronic Smog' Effects in Robotics using Stabilants

What is electronic smog?

This is a term coined to cover electromagnetic interference from any source, which potentially could affect the operation of robotic equipment. Obviously, it is a term that could apply to almost any field where complex electronic equipment is being used, from biomedical electronics to avionics. Advancements in IC design have made it possible to reduce the power level of signal lines in electronic equipment, with worthwhile savings in power as well as in the size of electronics packages, but this has made equipment more susceptible to outside electromagnetic interference.

What are the normal procedures for combating electronic smog?

There are two main categories for mitigation:

Reduction of electromagnetic radiation from equipment,

Reduction of the susceptibility of equipment to electromagnetic interference.

These complementary approaches translate into such things as better shielding of equipment both from the containment point of view of the former, and from the exclusion point of view of the latter. Often it is difficult for a factory to control external sources of electromagnetic radiation (such as radio & TV transmitters), and they must concentrate on reducing the damaging potential of electronic smog.

Robotics is especially susceptible to electronic smog, and in the early days of industrial robots, reports of several deaths attributed the malfunction of robotic equipment to outside electromagnetic interference.

While electronic smog may be combated through the use of better shielding design, this is of little use to equipment that is already installed.

In existing equipment, the procedure is usually one of making sure that existing shielding is properly installed, all signal and power leads are protected by shielding, and that connector integrity is good. What is not always appreciated is that thin film rectification effects can convert a connection into a radio receiver, and thus produce anomalous signals in the circuit using that connection.

This is especially insidious in factories where the atmospheric environment may contain chemicals which will cause connector corrosion. Many of these corrosion products in connectors lead to unwanted metal-to-semiconductor contact interfaces.

Although most robotic equipment is designed with environmentally secure connectors, after several years of service, the integrity of these provisions should be verified.

What else can be done?

Once all the electro-mechanical connections in the equipment itself, and all its connections to outside equipment are treated with a material (Stabilant 22) which minimizes or eliminates thin film or point-contact rectification effects, the susceptibility of the equipment to electronic smog will be reduced. It is also important that the shielding enclosures form a continuous shield to block EMI (Electromagnetic Interference). In this respect some equipment's shielding may be rendered ineffective by the painting of the shielding cases in the areas where the covers are screwed together. Sometimes spring "finger-stock" is used to ensure that a cover is sealed electronically all around its edges. Obviously, any paint or oils on the finger stock or its associated contact surface will render the EMI protection ineffective. The same can be true of corrosion or tarnish on the surface of these shielding devices. Thus, it may be necessary to treat finger stocks and mating contacts with Stabilant 22.

Stabilant 22 has proved to be effective at reducing the RF leakage (EMI) susceptibility of many different types of connectors.

What is Stabilant 22?

Stabilant 22 is an *initially non-conductive* block polymer that under the effect of an electrical field and/or when used in a very narrow gap between metal contacts, becomes *conductive*. The electrical field gradient at which this occurs is set so that the material will remain *non-conductive* between adjacent contacts in a multiple pin environment.

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

While Stabilant 22 exhibits surfactant action it is *not* sold as a contact cleaner. Equally, it exhibits quite good lubricating properties but is *not* sold as a contact lubricant. Its strength is in its *active properties* when used in a connection and the other properties are a bonus.

Where can it be used?

Stabilant 22 can be used wherever electrical contacts are used, in connectors of most types, or in switches. For example, one common use is to improve the connection reliability of socketed IC's in computers. In combating the effects of electronic smog, every connection in a system should be treated (with the exception of power interrupt switches).

Why should we use Stabilant over less expensive alternatives?

Stabilant 22 is expensive on a volume basis but is used in small quantities. It is unique in having a very long useful life once in place. Unlike other so-called contact treatments Stabilant 22 will not cross-link (becoming varnish-like) under the action of sulfur-based curing agents in elastomers, cutting oil residues, or the sulfur-bearing free-machining metal alloys used in some contacts. Thus, in combating electronic smog through the use of Stabilant 22, other connector-related problems will be prevented, increasing the MTBF (mean time between failures) of the equipment. In most types of service work, the cost of the time involved in removing and replacing a board will be much greater than the cost of the Stabilant used to treat the board. Here what is important is that not only will proper board treatment cure existing contact problems, but it will also prevent others from occurring thus eliminating the necessity of repeating the treatment at a later date! In other words, why do a job more than once?

In addition, Stabilants are one of the few viable alternatives to the repeated use of cleaning solvents in electronic maintenance and manufacture, and thus are not subject to the increasingly stringent and restrictive legislation applicable to solvents.

In what forms is Stabilant available?

Stabilant 22 is packaged in 15ml, 50ml, 100ml, 250ml, 500ml and 1 Liter containers. Stabilant 22 is available in two forms; as a concentrate Stabilant 22, and as an isopropyl alcohol-diluted form called Stabilant 22A. Because of the 4: 1 dilution, a given size container of Stabilant 22A will cost about one-fifth the amount of a container of Stabilant 22 for it has only one-fifth the amount of the concentrate in it. A third packaging is available for industrial-bulk users. Stabilant 22S packages the concentrate such that it occupies one-fifth the volume of an otherwise empty container. This allows the end-user to add his own diluent and saves the added costs of shipping isopropyl alcohol, as well as allowing the end-user to use an alternate diluent such as one of the Freon™ solvents.

What are the different ways to use Stabilants?

The concentrate, Stabilant 22 is most useful where the connector surfaces are out in the open such as the card-type connections. 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.

Is it available in a spray can?

Not at present. During the initial stages of our market research we did provide spray cans of the material, but the users found that in most cases it did not ease the application of the material, wasted many times the amount that actually got on the contact areas, and generally left a film of excess material that had to be cleaned up for appearances sake.

A further consideration is the replacement of chlorofluorocarbon propellants in spray cans with a highly inflammable mixture of butane and propane. Again, very little Stabilant 22 is necessary to treat a contact, so why waste it?

Is Stabilant just another contact cleaner?

No, it is important to remember that Stabilant 22 is an *electrically active* material which enhances conductivity within a contact without causing leakage between adjacent contacts. Thus, large quantities of the material do not have to be "hosed" on as is the case with cleaners.

How much should be used?

Normally, a final film thickness of from 1 to 2 mils of the concentrate is all that is necessary. In other words you want just enough to fill up the interstices between the contact's faces. Where you're using Stabilant 22A, you'll have to use enough so that once the isopropyl alcohol evaporates the desired 1 to 2 mil film of Stabilant 22 remains.

What is the 15mL service kit?

This was made up at the request of several manufacturers who wanted a standard kit that they could issue to their service personnel. It consists of a 15ml container of Stabilant 22A and some micro-brush applicators, all in a small capped tube. These applicators are reusable.

Why would anyone want to buy a half-liter on the concentrate?

Some manufacturers make large volume purchases, diluting the material as required for specific applicators used on their production lines.

Many end users have found that the material cuts their service costs so much that it is more economical to purchase Stabilant 22 in the larger container sizes with its attendant savings, rather than run any risk of being without the material. The number of uses tend to increase as customers discover the diversity of the problems that can be solved by the material. One user routinely applies it to the flashlight switches and batteries it issues to its security guards and has reported that the number of requests for both batteries and replacement flashlights has dropped appreciably.

How can I be sure that the material works?

We could cite the fact that Stabilant 22 is used by many hospitals on their bio-medical electronics to improve reliability of the equipment where lives are at in the balance. We could cite the use of Stabilant 22 by many broadcasting networks to achieve the last measure of reliability in critical network switching applications. We could cite its use in navigational aids, or the years of use in the audio field where even consumers found the material easy to use and its results impressive. But we still feel that the best way to find out 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.

Is Stabilant 22 hazardous?

Stabilant 22 comes with some minor precautions in normal use. It has caused no skin reactions (sensitization) in tests. Because of its moderate detergent action, it could remove skin oils and lead to drying and chafing, therefore skin spills should be washed off and an emollient-type lotion applied. If small amounts are accidentally orally ingested it will cause bowel looseness, while ingestion of amounts in excess of 200 ml of the concentrate could lead to more serious illness - Stabilant 22 has an LD₅₀ of about 5 grams per kilogram body weight. In the undiluted form, Stabilant 22 is non-flammable, however if its temperature is raised above 200° C the decomposition products will burn. Fire safety and other concerns are mainly related to the alcohol content of Stabilant 22A or 22E (isopropanol or ethanol respectively). Please consult the Safety Data Sheets for more details relevant to each product type.

Can it be used by untrained personnel?

The consumer version of Stabilant 22 which is sold as TWEEK™ has been used for several years now without problems.

What is the best way to apply it to a contact?

The 15ml and 50 ml containers have a "dropper" type cap that allows Stabilant 22A to be applied directly to such components as socketed IC's, switches, connectors, etc. Some end users prefer to buy larger quantities and use industrial syrettes to apply the material onto connections. Microbrushes (supplied with our Service Kits) or natural bristle sable brushes can be used to brush it on card-edge connectors. Cards can also have their edge connectors dipped into the dilute material.

In treating "finger-stock" electronic seals, the concentrate, Stabilant 22 may be wiped on just as if the technician were using any other protective product.

Does the action of Stabilant 22/22A deteriorate with age?

Stabilants have been in some field trial applications for over twelve years now without showing any sign of reduced effectiveness. The material has a high molecular weight and a very low vapor pressure, so it is not prone to evaporation.

Once again let us emphasize the point that unlike some other contact treatments containing oils, Stabilant 22 will not cross-link when exposed to certain materials such as high-sulfur brass, or when used on connectors having elastomer or thermoset plastic components with accelerant and curing agents, or when used on contacts where cross-link promoting agents are present in the environment. This phenomenon of "varnishing" does not occur with Stabilant 22.

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

This data has been supplied for information purposes only. While to our knowledge it is accurate, users should determine the suitability of the material for their application by running their own tests. Neither D.W. Electrochemicals Ltd., their distributors, or their dealers assume any responsibility or liability for damages to equipment and/or consequent damages, howsoever caused, based on the use of this information.

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