STABILANT 22

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APPLICATION NOTE

Use of Stabilant 22 in Avionics and Navigational Equipment

- ***What is Stabilant 22?***

  Stabilant 22 is an *initially non-conductive* block polymer that under the effect of an electrical field 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 not cause leakage* between adjacent contacts in a multiple pin environment.

  It 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 metier is in its *active properties* when used in a connection and the other properties are a bonus.

- ***What are its uses in avionics and navigational equipment?***

  Stabilant 22 can be used wherever electrical contacts are used, whether this is in connectors, or in switches. Whether it's ground, marine, or airborne applications the number of places where **Stabilant 22** or **22a** can be employed are almost too numerous to list.

  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. Although the reduction in power requirements and the use of more complex integrated circuits has enabled avionic equipment manufacturers to reduce the size of the equipment so that many installations can be handled with a one package unit, as well as permitting them to offer a host of new features on both commercial and general aviation avionics, 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 has increased the connector-related service problems. The use of microprocessors in avionics has made it much easier for a host of extra features to be added; once the microprocessor is there, implementation of these features is simply a matter of adding the extra routines to the internal software (in

ROM or EPROM) this type of system is more prone to "crashing" because of a contact problem.

There is also the problem of EPROM-based databases to consider. In Loran-C equipment, for example, the requirement for databases that can be updated periodically in order to accommodate new frequency, or other airport /nav-aid information means that EPROMS have to be socketed. Because of the vibration and cyclic pressure environment, these sockets, as is the case with most aviation connectors, are much more prone to contaminant-penetration; an IC socket that is virtually 100% trouble free in an on-the-ground application, such as a computer; may be quite prone to contaminant-based failures in an airborne avionics application.

Increasingly, the **Stabilants** are being used to overcome these problems. The increased contact integrity in this environment is a result of several factors. Under vibration conditions, small relative movements of contacts, because of "stiction" effects, are usually more abrupt, and thus accompanied by microphonics that can introduce spurious signals. As the thin-film contaminant level increases, the microphonics grow worse as the contacting surfaces encounter a non-homogeneous distribution of contaminants, some of which, being corrosion by-products may also exhibit rectification effects. The latter can not only alter waveforms and change critical timings, but can made the connector prone to RF interference. Simple lubrication of the connector can sometimes minimize these problems by allowing a wiping action that can wipe-out some of the layer of contaminants. But if the use of this type of treatment is accompanied by problems of "varnishing, ie., cross- linking of the oil, the solution is only of a temporary nature.

By providing a lubricating film that won't cross-link, **Stabilants** address this part of the problem. But they also have a good detergency and thus will keep existing contaminants both from adhering to and being burnished onto the contact surfaces. The electrically active properties of the **Stabilants** also counter any rectification effects by penetration corrosion films. And, of course, the very presence of the **Stabilant** material prevents many contaminants from entering the interstices of the contacts.

The **Stabilants** thus can substantially improve 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, the use of the **Stabilants** 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 necessity, in many cases, of verifying that the repair work is in calibration.

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, thin film rectification effects may occur, making the system more susceptable to the electromagnetic pulse side- effects of lightning. These same connector faults can also make the system more susceptable to RF interference from the facility itself or from other sources.

With the increasing sophistIcation of the equipment, it is not unusual to find that the power level of the individual circuits has been substantially reduced in order to con-

serve power and/or minimize heat-dissipation requirements. The result is that many of the the connections in the system are operating at much lower current levels, and thin film 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, it has made the same equipment much more sensitive to connector problems, whether they be card-edge connectors or those in socketed IC's.

While the material was designed to substantially increase the reliability of all forms of contacts, **Stabilant 22** is also finding increased use as an insertion lubricant for multi-pin IC's. Here it almost eliminates the possibility of bending-under a pin on an IC.

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.

- ***Why should we use Stabilant over less expensive alternatives?***

  We grant that the material itself is expensive. However 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 sulphur based curing agents in elastomers, cutting oil residues, or the sulphur-bearing free-machining metal alloys used in some contacts. In most types of service work, *the cost of the time involved in removing and replacing a module will be much greater than the cost of the* ***Stabilant*** *used to treat the connectors.* Here, what is important is that not only will proper connector treatment cure existing contact problems, as Stabilants stay *resident*, they will prevent other problems from occurring, thus eliminating the necessity of repeating the treatment at a later date!

  In other words, why should you have the expense of doing a job more than once?

- ***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 diluant and saves the added costs of shipping isopropyl alcohol, as well as allowing the end-user to use an alternate diluant such as one of the other solvents used in electronics.

- ***What is the difference in use of the Stabilants?***

  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 diluant 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 fact that while chlorofluorocarbon propellants are no longer generally used in spray cans, a highly inflammable mixture of butane and propane is often substituted. Remember, 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 stays *resident* in the contact-pair, enhancing 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.

- ***Just 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 and electronics equipment service organizations who wanted a standard kit of reasonable dimensions that they could purchase and stock in quantity, issuing it to their field service personnel as required. The service kit consists of a 15mL container of **Stabilant 22a** and some soft-tip applicators, all in a small capped tube. The applicators are reusable.

- ***Why would anyone want to buy quantities of the concentrate?***

  Quite a few manufacturers and larger service organizations prefer to make large volume purchases, diluting the material and issuing it, as required, for specific manufacturing or field service requirements.

  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 rather that run any risk of being without the material. The number of different applications tends to increase as users discover the large number of problems that can be solved by the material.

- ***How can I be sure that the material works?***

  Quite apart from the fact that **Stabilant 22** has passed a number of stringent field tests before being issued a NATO supply code number, we could cite the fact that

Stabilant 22 is used by computer companies, and is used by many hospitals on their bio-medical electronics to improve reliability of the equipment where lives are 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 we could cite 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 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.

Stabilant 22 has already been TSO'd by a major avionics manufacturer.

- *Can I use Stabilant 22 in other equipment?*

It can be used in computers, test equipment, cameras, just about everywhere there's a low voltage signal or control connection. For example, the effect of **Stabilant 22** in Computers is to reduce the number of times the system locks-up or crashes, sometimes it even eliminates non-software crashes completely.

When used on socketed IC's, photo-couplers/isolators, rotary, push button, or slide switches, or even on BNC connectors, the net effect is usually to make the proper operation of the equipment less erratic, and in the case of IEEE-488 buss-controlled equipment, to cut down on the potential for system lock-ups.

The **Stabilants** have also been used in flight simulators.

- *Is the material hazardous?*

No, **Stabilant 22** has caused no skin reactions in tests, and is, in the undiluted form, non-flammable. If orally ingested it will cause bowel looseness. **Stabilant 22** has an LD_{50} of about 5 grams per kilogram body weight.

In the United States, users should be aware that none of the **Stabilants** are subject to the Toxic Substance Control Act, nor are they reportable under SARA Title III. The fact that the Solvent Burden/Year for **Stabilant 22a** is about 200 times less than solvent-cleaning treatments has made the **Stabilants** the treatment of choice for many environmentally-concerned agencies.

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

The 15mL and 50 mL containers have "dropper" type caps that allow **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. Camel's hair or sable brushes can be used to brush it on card-edge connectors. Cards can also have their edge connectors dipped into the dilute material.

When using **Stabilant 22** as an IC insertion lubricant and large quantities of IC's are involved, we would suggest that an applicator be made up. This consists of a rectangle of conductive foam (of the type used to prevent static-charge damage of IC's) be epoxied to the bottom of a flat tin. Flood the foam with **Stabilant 22**. The IC can then be pushed down on the foam thus applying **Stabilant 22** to its pins.

- *Does the action of Stabilant 22/22a deteriorate with age?*

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 sulphur brass, when used in connectors containing rubber or thermoset plastic components which themselves contain accelerants and curing agents, or when used in areas where cross-link promoting agents are present in the environment. This phenomena of "varnishing" does not occur with **Stabilant 22**.

The **Stabilants** do not contain any silicones so there is no possibility of the phenomena of a contaminant inducing the silicone to cross-link to form a hard, glass-like layer on the contact's surface..

The **Stabilants** do not affect elastomers save for some slight swelling on some materials. The diluants employed (isopropyl alcohol) is much more likely to cause problems, although it is gone as soon as it evaporates. Nor are plastics generally affected. We don't recommend the use of **Stabilants** on deposited- carbon-film or resistive-paint-film type potentiometers.

Stabilants have been in some field 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, thus it is not prone to evaporation. Unless removed by cleaning, it will probably outlast the usefulness of the electron equipment on which it is used.

These many factors combine to make **Stabilants** the connector treatment of choice where long term reliability is essential.

NATO Supply Code 38948 - 15 mL of S22a has NATO Part # 5999-21-900-6937

The **Stabilants** are patented in Canada - 1987: US Patent number 4696832. World-wide patents applied for. Because the patents cover contacts treated with the material, a Point-of-sale License is granted with each sale of the material.

MATERIAL SAFETY DATA SHEETS ARE AVAILABLE ON REQUEST

NOTICE