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**Number 14**

## **APPLICATION NOTE**

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### **Use of Stabilant 22 in Educational Computing & AV Equipment**

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#### **Introducing Stabilant 22**

Stabilant 22 is an initially non-conductive block polymer that when used in a thin film within contacts switches to a conductive state under the effect of the electrical field. The field gradient at which this occurs is set such that the material will remain non-conductive between adjacent contacts in a multiple pin connector environment.

*Thus, Stabilant 22 provides the connection reliability of a soldered joint without bonding the contacting surfaces together!*

Contacts are generally the weakest link in any piece of electrical/electronic equipment whether it be in low current devices found in computers or higher current circuits found in automotive and aviation applications, to name only a few. The use of Stabilant 22 or its isopropanol-diluted form, Stabilant 22A, will make contacts from 10 to 100 times more reliable, eliminating costly service call-backs and ensuring customer satisfaction.

#### **Where can it be used?**

Stabilant 22 can be used wherever electrical contacts are used, in connectors, switches or potentiometers. For example, common uses range from improving the connection reliability of socketed IC's in computers to wiring harness connectors.

#### **What is the effect of Stabilant 22 in computers used in education?**

The effect of Stabilant 22 in computers is to increase long-term reliability and reduce repair costs. This is done by reducing the number of times the system locks up or crashes due to contact malfunction, the single greatest cause of computer malfunctions. Often, it eliminates non-software crashes completely.

There are a very large number of contacts in each computer. Many keyboards use an array of electromechanical switches. Other contacts include socketed integrated circuits, and in the card-edge connectors used on plug-in boards.

Yet others are used to connect keyboard, mouse and other peripheral equipment such as printers, scanners, etc. Often it takes just a single failure of one of these contacts to cause a computer to crash.

In educational applications, it's no secret that the computers receive very hard usage, usage that sometimes slips over into near-abusive levels. Quite often, a computer will be down because of an intermittent problem caused by a connector, a problem that may not re-occur on demand when the technician is attempting to service the unit. No one should be surprised when such a problem is almost impossible to locate even though it may be hard for the teaching personnel to understand why it is so difficult for the technicians to solve this type of problem on a permanent basis.

Let's review the conditions within a contact that cause this type of problem. If we were to examine the connecting surfaces of a contact under a microscope, we would find that the metal, which looks quite smooth to the naked eye, seems as rough as a mountain range. The actual contact is made by a number of points scattered over the total area of the contact. In between these points is open space. The volume is certainly small, but it does provide a path for the entry of airborne contaminants such as moisture, oils, waxes, chemicals, and even tar from cigarette smoke. While many contacts are gold plated to prevent corrosion, this does not prevent the entry of airborne contaminants. The situation is even worse for many contacts (such as some cheaper RS-232c printer connectors) that do not use gold plating.

Depending upon the type of connector, contaminant entry may cause several possible effects:

- 1) The contaminant may swell, forcing the contact points apart,
- 2) The contaminant may spread over the contacting points leaving a thin film having odd partially conductive properties,
- 3) The contaminant may cause corrosion of the contacts. This can cause some very strange effects as many metal oxides and sulfides exhibit semi-conductive effects that may result in turning the contact into a rectifier. While this might not bother the signal by itself, it would make the contact very susceptible to any RF signal that might be picked up. Thus, a radio signal could cause a signal artifact within the computer that could cause it to crash or could result in corruption of stored data.

Sometimes, temporary relief is as simple as unplugging and replugging the connector, although this may only shift contaminants about as the contacts are re-seated. In the case of RF susceptibility, the problem may only exist when the computer is in a specific physical location. Where AM/FM/CB/ham radio or TV broadcast signals are the source of interference, moving the computer or its cables even a few feet may make the problem go away. To complicate matters, some broadcasting stations change their antennas' directional patterns at different times of the day which may alter the RF fields near the computer. Thus, a computer that might fail in the classroom might function perfectly in the test facility. But the potential for failure is still there.

There are other environmental hazards as well. No one would expect soft drinks or coffee to find their way into keyboard contacts, much less the computer itself, yet it does happen.

Contacts, including electro-mechanical switches, are generally the least reliable part of any system. As the number of contacts increases, and as the power level of the signals handled by these contacts decreases, the potential for system malfunction increases very rapidly.

The shift to ICs requiring very low operating currents and voltages has cut the power requirements of microcomputers tremendously, but it has also made them much more susceptible to both RF interference (sometimes called Electronic Smog), and even the slightest amount of contaminant penetration.

Stabilant 22 (also available diluted with isopropyl alcohol as Stabilant 22A) offers the only active means of ensuring contact reliability. Unlike cleaners, the material is applied and left in place! This is technically termed an active or resident treatment. Use it once throughout a computer and one finds that crashes due to contact problems are virtually eliminated. This translates into very large savings in maintenance not to mention an improvement in the availability of computer resources to the instructional program itself!

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

Stabilant 22 is expensive compared with less capable contact treatments. However, it is unique in having a very long useful life once in place. Unlike other contact treatment materials, 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. In most types of service work, the cost of the time involved in removing and replacing a board will be several times greater than the cost of the Stabilant used to treat the board. What is important here is that a total treatment with Stabilant 22 will not only cure existing contact problems, it will prevent others from occurring. This eliminates the burden of repetitive types of repair work such as numerous contact cleanings and cable replacements at a later date!

In other words, why pay the extra costs of having to do the same job several additional times?

### **What are the effects of Stabilant 22 when used in computer peripherals?**

It is just the same as when used in computers. Printers usually work without trouble for the first few months. But there comes a time when it seems as if they are 'possessed'. This is especially true of units which are operated from the Centronics-type parallel interface, which is highly susceptible to connector malfunction. Treatment with Stabilant 22 can prevent these problems on older units and those connected with USB cables.

Stabilant can bring reliability to LANs as well. Whether the LAN uses coaxial cable with BNC connectors or CAT-5/6 cables with RJ-type connectors, Stabilant 22 applied to the cable and port connectors and to the card-edge connector used on plug-in LAN boards can ensure years of trouble-free operation,

When used on socketed ICs, photo-couplers/isolator connectors, rotary, push button or slide switches, the net effect is generally to make the operation of the equipment less erratic, and in the case of IEEE-488 bus-controlled equipment, to cut down on the potential for system lockups.

## **Can Stabilant 22 be used on Audio-Visual equipment?**

Most A/V installations do not have nearly so many contacts as computer systems and therefore the effects of using Stabilants are not quite so dramatic. Nevertheless, there are many places where the Stabilants can stop annoying malfunctions, increase reliability, cut down on signal distortion, improve signal-to-noise ratios, and save maintenance costs in these installations. We have been told of several cases where language labs' devices were almost unusable because of age-related problems. There was excessive noise and distortion in the audio channels, switching was not reliable, and even the headphone connectors were intermittent. The cost of equipment replacement was well beyond the school's budget and maintenance costs were increasing rapidly. After all the connections were treated with Stabilant 22 (many connections could be treated with the dilute form - Stabilant 22A - without disconnection of the wiring) the labs functioned smoothly and reliably once again! Maintenance costs also dropped to a much more manageable level.

## **In what packaging sizes is Stabilant available?**

Stabilant 22 is packaged in 5mL, 15mL, 50mL, 100mL, 250mL, 500mL and 1 Liter containers. Stabilant is available in several forms; as a concentrate, Stabilant 22, as an isopropyl alcohol-diluted form called Stabilant 22A or the ethanol-diluted form, Stabilant 22E. Because of the 4:1 dilution, a container of Stabilant 22A will cost about one-fourth the amount of a same-size container of Stabilant 22; it has only one fourth the amount of the concentrate in it. An additional packaging form 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 the alcohol, as well as allowing the end-user to use an alternate diluent such as one of the other solvents used in electronics service.

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

The concentrate, Stabilant 22 is most useful where the connections 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 and simply wasted many times the amount that actually got on the contact areas. It generally left a film of excess material that had to be cleaned up if only for appearances sake.

A further consideration is the fact that although chlorofluorocarbon propellants are no longer generally used in spray cans, often a highly inflammable mixture of butane and propane is 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 that stays on the contacts; once applied, it enhances conductivity within mating contacts without causing leakage between adjacent conductors. Thus, large quantities of the material do not have to be "hosed" on as is the case with many 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. When 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 reusable micro-brush applicators, all in a small capped tube to keep everything together in a toolbox or on the shelf.

### **Why would one buy a larger container of the concentrate?**

Many manufacturers make large volume purchases, diluting the material 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, such as 100mL, 250mL or 500mL, rather than run any risk of being without the material. The number of uses tends to increase as users discover the large number of 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 replacement units 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 stake, 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 the fact that it has been TSO'd for use in air-navigational aids & instrument landing systems, 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 on hand 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 on known defective connectors and satisfy yourself.

### **Is Stabilant 22 hazardous?**

Stabilant 22 (concentrate) has caused no skin reactions or sensitization in tests. In the undiluted form it is non-flammable, although if its temperature is raised above 200°C, the decomposition products will burn. If orally ingested in small quantities it will cause bowel looseness although ingestion of quantities in the order of 200 ml could cause more serious illness. Stabilant 22 has an LD<sub>50</sub> of about 5 grams per kilogram body weight. In the form of Stabilant 22A, the isopropyl alcohol content accounts for some precautions due to flammability and toxicity.

In the United States, neither Stabilant 22 or Stabilant 22A are subject to the Toxic Substance Control Act (TSCA) and neither are reportable under SARA chapter III. In those states having restrictions on the amount of solvent used in coatings, the fact that the use of even Stabilant 22A results in a reduction in the equipment solvent burden/year by about a factor of 200 has led them to be the contact treatment of choice for environmentally conscious agencies.

### **Will Stabilant 22 cause damage to the equipment?**

No. The materials have been extensively tested for compatibility with circuit-board materials, conformal coatings, as well as with the various plastics and elastomers encountered in electronics. Isopropyl alcohol (found in Stabilant 22A) is popular as an electronic cleaner, so most materials are resistant to its solvent effects. That's not to say that there is no chance that somewhere, someone may be able to devise a cheap plastic material that might show susceptibility to degradation from the Stabilants, but because of all the solvent-compatibility requirements that are in place in the industry, it is doubtful if this would ever be used in any commercial-quality electronic equipment.

### **Can it be used by untrained personnel?**

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

### **What is the best way to apply it to contacts?**

The 5mL, 15mL and 50mL containers have a "dropper" type cap that allows Stabilant 22A (or 22) to be applied directly to such components as socketed ICs, switches, connectors, etc. Some end users prefer to buy larger quantities and use industrial syrettes to apply the material onto connections. Natural bristle brushes, or the micro-brushes supplied in our Service Kits can be used to brush it on card-edge connectors. Cards can also have their edge connectors dipped into the dilute material.

## 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 sulfur brass, 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.

Stabilant 22 has been in some applications for over twelve years (at the time of writing) without showing any sign of reduced effectiveness. Some customers report longer times than our published 15-year shelf life. Since it has a high molecular weight and a very low vapor pressure, it is not prone to loss by evaporation. Stabilants are non-reactive with other materials and unlike many contact greases (which are composed of a volatile oil combined with a soap-like material) there is nothing to evaporate or harden. The surfactant action together with the lubrication properties when combined with the electrically active nature of the material ensure that treated connectors will often continue to function properly even though the equipment itself may be so old as to be technically obsolete!

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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