STABILANT 22

D.W. ELECTROCHEMICALS LTD.
70 Gibson Drive, Unit 12
Markham, Ontario
L3R 4C2 CANADA
Phone: (905) 508-7500
Email: dwel@stabilant.com

Number 28

APPLICATION NOTE

Use of Stabilant 22 on RF Enclosure Seals

What types of RF seals are in general use?

The most common seals encountered on RF shielded enclosures are:

The finger stock seal

This type of seals employs a series of thin spring fingers which are generally manufactured as a strip of material. The finger stock is attached to one component of the closure and makes electrical contact with the other component. There should be sufficient force to ensure that a positive contact is established and maintained, ideally enough pressure so as to exclude oxygen from the joint.

The knit or wire braid seal

Utilizing a compressible element made from a wire braid/weave component resting in or clamped in a groove, this type of RF seal is usually arranged so that the braid is part of the cover and seals against the edge of the sheet metal forming the enclosure.

The conductive elastomer seal

Here a molded or extruded strip of conductive elastomer is used to establish contact between the two parts of the closure.

What are some of the problems associated with these RF seals?

As is the case with most connectors, the major problems are contamination and corrosion and the effect they have on RF leakage through the seal. In fact, some corrosion products exhibit semiconductive action. The rectification that takes place in these unwanted junctions may result in an unacceptable amount of the local RF field being demodulated and audio frequency signals introduced, re-radiated as an RF signal or signals at a different frequency or a combination of these.

The problem can be prevented by maintaining sufficiently high contact pressure so as to exclude oxygen, moisture, etc. from the contacting areas.

However, the pressure required (for example, in an IC socket, approx. 3 oz. pressure per pin is applied laterally) can be so high as to make the total closing force unacceptable for all but the smallest of RF enclosures.

The next step is one of securing a seal with acceptable pressures. At times it may seem that there is no hope of maintaining a continuous all-around seal. In fact, in the design stage it may be better to accept the improbability of a continuous seal and concentrate on determining what spacing of excellent contact points would be acceptable, designing the seal so that the spring force is concentrated at these points.

We have not overlooked the fact that for some applications involving a low power RF field of very uniform gradient, a capacitive seal may be sufficient - this is the exceptional case. Most RF enclosures aim to create a Faraday cage effect, requiring the components to be at a single (usually ground) potential. Erratic contact here can compromise the protective value of the seal.

Where environmental conditions are less than ideal, such as the presence of salt, moisture, pollution products, and even cigarette smoke, the problem can range from thin films of material preventing perfect contact, to corrosion-product encrustation of the contacts. It is important to note that (in the absence of ablative effects) the corrosion products may occupy much more space than the metal parts from which they were formed, leading to physical changes causing problems ranging from jamming of the cover to deformation of the seals. Sometimes a very small amount of contamination can result in a major problem.

Designers of buildings that are set up to provide a "reasonable" environment for electronic equipment may forget that most openings (e.g., for people to enter and exit, ventilation systems using outside air sources, etc.) will allow some entry of outside contamination. An example is the typical salt-air and fog encountered in costal areas.

Another problem is galvanic corrosion. This is caused by the use of dissimilar metals (or finishes) on the two surfaces forming the RF seal. Given the presence of any moisture, there will be an electrical potential set up be tween the two surfaces which can eat away one of the surfaces.

It must also be remembered that given an RF field of sufficient gradient, there may well be a potential difference (albeit only AC) between the various components of the shield system, which will in increase as the RF seal develops problems further aggravating that same problem.

Aluminum cabinets with anodized surfaces can suffer contact problems because the anodizing produces a coating of non-conductive aluminum oxide that is thicker than the metal usually acquires by simple air exposure. (Electrical contact is made to aluminum when the very thin air-oxidation passivation layer is broken-through under normal metal-to-metal contact force – not so easily done on a tough anodized surface).

Silver plating is more desirable; silver oxide is somewhat conductive but the more common sulfur-based tarnish products are insulating or semi-conductive, and rectification can sometimes occur.

For elastomer-based seals refer to the following section.

Can Stabilant be used to solve these problems?

While not developed for this specific application, Stabilant products can be used to good advantage. Because of factors involving formation of corrosion products within contacting areas of low pressure Stabilant treatment may not stop the problem in the same way as with discrete connectors.

Even in a non-ideal situation, Stabilant 22 will reduce the problem to the point where the interval between failures is both extended and more predictable, allowing for a maintenance schedule to be set up for the treating of the RF seal areas..

Consideration must be given to possible galvanic incompatibilities caused by the plating on the woven wire or braided wire if that is the type of seal being used. Solder alloy plated, tin plated copper or a mixture of these, or even solder or tin plated steel wire can be especially troublesome when combined with an aluminum case. Here, the electrochemical balance always results in aluminum being corroded.

Even in the absence of a galvanic mismatch, aluminum is prone to ongoing oxidation/corrosion that inevitably leads to poor contact. Stabilant 22 has a strong surfactant action and part of its protective effect is to lift loose oxide and hold it in suspension. Even a thin film of the concentrate will help in this situation. But the material will have to be periodically cleaned off with a solvent such as isopropanol and the concentrate re-applied. The general limits of protection are about six to nine months in a coastal area with thin films, and from nine month to a year or more with thicker films of the concentrate.

Elastomeric seals often consist of a good compression-set-resistant elastomer compounded with a very finely divided carbon-black (grade “SAF”). Stabilant 22A contains isopropanol, which may cause swelling and degrade the compression-set properties of some elastomers such as Buna S or fluorosilicone. Therefore, we would suggest that where there is any doubt as to the compound, the concentrate (Stabilant 22) should be employed. Please also refer to our Application Note #21, "Compatibility of Stabilant 22 with Elastomers".

A possible problem which might reduce the initial effectiveness of Stabilant 22 treatment is as follows: If there are any unsaturated oils present on the metal that is in contact with the elastomer, the curing agent/accelerator used in the elastomer may cause these oils to cross-link (or cure) either making the elastomer stick to the metal or produce a nonconducting varnish-like coating on the metal's surface. This can even happen with skin oils. The situation can be aggravated where the elastomeric seal has been cemented to one component of the closure, if the cement and/or primer contains an isocyanate (which can promote cross-linking). This problem does not occur with Stabilant 22 by itself, but be sure to remove any residual patina from the metal surface before using it and the Stabilant treatment will prevent the problem from returning.

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.