

CORTEC

Technical Support

VCI Emitters - Common Questions:

1. What is an "Emitter"?

Emitters are devices (cups, foams, films, bags, etc.) which contain special compounds called **VCI**s (**V**olatile **C**orrosion **I**nhibitors) which evaporate (emit) into the surrounding enclosure or package. This is much like water as it evaporates but it takes place over months or years instead of minutes or hours. Cortec generally refers to **Emitters** as those products that are individually packaged, such as our VCI-101, VCI-105, VCI-110 or 1-MUL pouches and used in single applications. However, our VCI-foams and films are often used in the same manner. In general, most Cortec products contain VCIs and will act as emitters although they are not normally called emitters.

2. How are Emitters Used?

Emitters are used to protect enclosed metal components from corrosion by placing one or more of the devices in a container, package or other enclosure. This includes electronics cabinets of all types, computers and other electronic devices, electrical control boxes used for plant equipment, control boxes containing relays and switches, electronic gear aboard ships and airlines, tool boxes, spare parts boxes and storage units, fuse boxes, telecommunications devices, analytical equipment, gun cabinets and any other enclosure that contains metals that might corrode. They are also used extensively in shipping containers and packaging.

3. What Will Emitters Do For Me? Why Use Emitters?

Emitters will save money (and time) for almost any company using electronics or doing processing or manufacturing. They do this by reducing corrosion that affects production and product quality in several ways:

- Emitters reduce electrical/electronic failures in relays, switches and connectors by preventing corrosion, the **Number 1** cause for failure of electronic and electrical devices.
- Reduce maintenance by reducing failures and parts replacement.
- Extend equipment lifetime.
- Improve reliability by reducing noise levels, relay chatter and switch reliability and continuity.
- Reduce accumulation of contaminants. The quality and performance of electronic devices will also improve in that they will look cleaner, function more reliably and have lower electronic noise.

4. How Does an Emitter or VCI Work?

The chemicals (VCIs) which vaporize into a package or enclosure are usually a blend of several special compounds that form a very thin layer, only a few molecules thick, on the surface as they interact with all metals present. These chemicals are unique in that they prevent the interaction of air and water moisture with the metal, thus preventing corrosion.

5. How Long Does it Take for an Emitter to Become Effective?

This depends on the size, shape and temperature of the enclosure. In general, at room temperature, emitters begin working immediately for metals immediately adjacent to them but it may require as much as 24 hours for metals at the extreme ends and internal spaces to become saturated with VCI vapors.

6. How Can Emitters be Made Effective Sooner?

This can be done in several ways:

- By using more than one emitter and locating them at each end or along each edge of the enclosure.
- By fogging the entire package initially with one of our VCI powders such as VCI-307, VCI-309 or VCI-609 or with VCI-337 or VCI-347.
- By treating some of the internal compounds with a VCI rinse or cleaner, such as VCI-416 or VCI-238 before placing them in the container or enclosure.
- By increasing the temperature of the parts or atmosphere.

7. Are Emitter Vapors Hazardous?

Most emitters contain chemicals which are not known to be hazardous, toxic or flammable. Some of the chemicals are very similar to compounds that have actually been used in foods and beverages.

8. Are Emitters Environmentally Safe?

Cortec emitters, like most of our other 200+ products, are very environmentally friendly and contain no known environmentally restricted or harmful compounds. Cortec's position on the environment is well described in our technical paper CTP#5, presented in Melbourne, Australia, on behalf of the Australian EPA.

9. How Do You Remove Emitter Films?

The films left by emitters are only a few molecule thick (~1/25,000th of 1 μ or 1/500,000th of 1 mil). They are much thinner than most contamination layers which form on virtually any surface. It is unnecessary to remove them and they have little effect on adhesion or subsequent coatings.

10. Don't Emitter Vapors Disappear When the Box is Opened and Closed?

Yes, some of the *vapors* may be lost when a container is opened, but the VCIs already adsorbed on the metals will not be disturbed immediately and will continue protecting the metal. As soon as the container is closed, the VCIs will again fill the containers with vapors.

11. How Many Times Can the Container Be Opened and Closed Before Depleting the Emitter?

This depends on the chemical contaminants in the atmosphere, but under normal circumstances, if **all** of the vapor is lost from the container and **all** of the vapor is desorbed from **all** of the components in the container, the container can be opened and closed approximately 4000 times or 10 times a day for one year!

12. What About Enclosures/Cabinets/Boxes Which are Not Completely Sealed?

The lifetime of the device will be somewhat shortened, possibly to one year or less. Although emitters are specified for "enclosures" they will still provide protection for systems which have some air flow through them. The degree of protection will depend on the level of contaminants in the air and the rate of air leakage. The amount of chemical VCIs that are already adsorbed on metal components will not be easily displaced. Once they have been coated, protection will continue for a considerable time.

13. What About Cabinets With Fans or Other Forced Air Throughput?

Again, the lifetime of the devices may be shortened but they are still able to provide excellent protection depending on the quality of the air flowing through them. This protection is best achieved by allowing the VCI vapors to equilibrate and coat the metals during off hours when the fan or forced air can be turned off, such as over the weekend or evenings.

14. How Do VCIs Affect Electrical Characteristics Such as Resistance, Dielectric Strength, etc.?

All testing and use of VCIs used in emitters to date indicates that they have no adverse effects on electrical parameters. In fact, Independent Testing Laboratories have shown that when VCI emitters are used, the contact resistance of relays and contacts remains much lower because they inhibit oxide and contaminant build-up on the contacts. Other tests have indicated no increase of leakage currents at any point on PC boards or electrical circuitry.

15. What About VCIs on High Frequency Equipment?

Separate tests by an Independent Laboratory indicate that VCI emitters do not adversely affect the performance of RF equipment.

16. What About Using Emitters in High Voltage Equipment?

VCI's have been used in equipment which has operating voltages exceeding 5000 eV. We suspect that if they are used at higher voltages there will also be no adverse interactions. In fact, it is very likely that they will minimize formation of corrosive components, which could otherwise lead to increased breakdown.

17. Do Emitters Provide Desiccant Activity?

VCI emitters provide a small amount of desiccant activity, but their main attribute is the protective "skin" or layer they produce on metal surfaces. This layer helps eliminate the normal destructive reactions which otherwise occur with moisture, making desiccant ability only a secondary feature.

18. Are Emitters UL (Underwriter Laboratory) Approved?

UL approval is primarily a requirement for fire characteristics. Cortec emitters presently do not have a UL approval, although there have been very few requirements for such.

19. What About Use of Emitters Under Harsh Conditions?

VCI emitters have been used very successfully under extremely adverse conditions, including remote control switch and relay boxes located near the sea, in atmospheres containing over 200 ppm of mixed acids such as SO₂, H₂S, HCl, etc., and in partially open control boxes in harsh industrial atmospheres.

20. What About Protection of Silver, Gold, Tin and Other Metals?

Cortec emitters use a unique blend of several different chemicals to provide a corrosion inhibitor with one of the widest ranges of protection possible. They are multimetal inhibitors and will protect most metals under many conditions.

21. What Are the Effects of Higher Temperature?

In general, the higher the temperature, the faster the VCI's will vaporize. This means they will reach equilibrium sooner but they will be depleted sooner. At an operating temperature of 120° to 140°F, we would expect the useful lifetime to start decreasing. When emitters are used continuously at these higher temperatures we suggest that they be replaced more often than once every two years.

22. How Does One Know When the Emitter is "Used Up"?

There are several ways to determine if an emitter is still useful, but these methods are so costly that we recommend automatically replacing the emitter once every two years. The emitter should be replaced more frequently than this if the conditions are severe or there is significant leakage or loss of the internal air through frequent opening and closing.

It is simple to determine if there is powder left in the emitter simply by shaking it. Or, if there are signs of corrosion beginning on the equipment, it is most likely that the powder in the emitter has depleted.

More sophisticated methods also exist utilizing specific detection equipment, but this is generally more expensive.

23. What About Using VCI Emitters in Older Equipment?

Although emitters will not reverse prior corrosion, when they are used in older equipment, they will extend lifetime, reduce failures and curtail further corrosion.