

CORTEC TECH BRIEFS
CLEANING & CORROSION
A PARADOX

By

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As a World leader in Corrosion control, CORTEC has also been deeply involved in methods and technology of cleaning surfaces. As a result, Cortec has developed products to clean most metals under most conditions. The following brief discussion provides a clearer understanding of the importance of cleaning, what to look for in surface cleaning products, how and when they might be applied and what considerations should be addressed.

To understand **CORROSION** one must understand cleaning.
To understand **CLEANING** one must understand contamination.
To understand **CONTAMINATION** one must understand surfaces.
To understand **SURFACES** one must understand Surface chemistry.

Cortec relies on their expertise in each of these areas to constantly design and develop technology for **TOTAL CORROSION CONTROL** Worldwide and in each installation where its products are used. The following provides a better understanding about **CLEANING, CONTAMINATION, SURFACES, and SURFACE CHEMISTRY** and how this can lead to optimum **CORROSION CONTROL**. **CORTEC** has other special **TECHNICAL BRIEFS** covering many specific topics in more detail.

What is a SURFACE?

The term "SURFACE" is vague and ambiguous but it is where corrosion begins. The term is more explicitly described using the illustration below. In industrial applications, the term "surface" is not merely a plane with no depth as in mathematics. To understand

surface chemistry, contamination, corrosion, and cleaning, the term “surface” must imply some degree of “thickness” on a very microscopic scale; even molecular level. Although surface roughness and physical shapes etc. can have effects, almost all initial interactions begin at the atomic (or molecular) scale. This chemistry dictates much of the performance of the surface, such as corrosion, adhesion, friction, reactivity, etc. Marco features including surface roughness, texture, shape, pits, cracks, scratches, etc. have a more general effect in collection of debris, retention of contamination, formation of electrochemical centers, and abrasion. (Figure 1. Structure of a “Typical Surface”).

What is SURFACE CONTAMINATION?

The term “Contamination” is also misleading. What is considered extremely gross contamination in one case may be impossible to see visually. Conversely, what appears by eye to be very crude contamination may have no measurable affect on product performance. Surface contamination is a major cause for corrosion, but in some cases it may actually prevent corrosion.

For simplicity, we consider contamination to be the presence of any material which is not intentional or planned. To properly assess its effects all of the following factors must be considered.

| | | |
|---------------|---------------|----------------------|
| CHEMICAL TYPE | PHYSICAL TYPE | CONCENTRATION |
| THICKNESS | DISTRIBUTION | PROPOSED APPLICATION |

In general, it takes only a very thin layer of contamination of the right type at the right concentration to initiate corrosion, prevent adhesion, or cause discoloration. In pioneering the development of corrosion inhibitors and cleaning products, CORTEC has very sophisticated surface analysis techniques available. There are four major analytical instrumental techniques commonly considered applicable to analysis of these thin outer surface layers. They include ISS (Ion Scattering Spectroscopy), SIMS (Secondary Ion Mass Spectroscopy), XPS (Xray Photoelectron Spectroscopy also ESCA), and AES (Auger Electron Spectroscopy).

How do I select a Cleaning Product?

Cortec has developed cleaners for nearly every application including most metals, aluminum, rust removers, and even paint strippers. Based on our years of experience in analysis of coating and adhesive failures, poor surface cleaning is a major cause. Hence effective corrosion inhibitors such as those supplied by CORTEC must be used immediately after or even within the cleaner.

For example, Cortec VCI-415 is specifically designed to clean most metals, and it contains unique Cortec additives to provide short term corrosion protection.

VCI-416 and VCI-419 are heavier duty cleaners. Cortec even provides extremely powerful cleaners for removal of rust and scale deposits.

The chemical nature of contaminants on a surface dictates the requirements of the cleaner. Most organic materials can be cleaned easily with less aggressive cleaners although highly degraded organic material is not very soluble. Inorganic contaminants often require very aggressive cleaning and may even require conditions that are too harsh for practical use due to safety, toxicity, and environmental requirements. They may actually require physical cleaning. Yet Cortec has designed its cleaners for 'friendly' use. They are non-polluting, biodegradable, nitrite free, non-corrosive, and free of noxious solvents like 1,1,1-trichloroethylene, methylene chloride, CFC's, and flammable solvents.

What are the important things to remember about CLEANING?

Some practical "RULES" of surface cleaning are summarized below. However, each and every product and its individual components should be carefully evaluated regarding its original contaminants and final requirements.

1. ALL surfaces are contaminated.
It is the amount, type, and thickness of contamination we are concerned about.
2. One cannot merely clean any surface.
You must know what you are doing.
3. A particular cleaner will not clean ALL surfaces.
An appropriate cleaner and procedure must be chosen.
4. ALL cleaned surfaces will automatically get recontaminated.
This is due to natural, thermodynamic driving forces.
This type of contamination may be controllable.
5. It will COST \$\$\$ to clean a surface properly.
6. It will COST many, many more \$\$\$\$\$\$ if it is not done properly.
7. Proper use of CORTEC Cleaners, metal working products and corrosion inhibitors can save many \$\$\$\$\$\$.

Packaging with CORTEC VCI Courtesy of OKS GmbH, Munich, Germany

A very successful application for CORTEC products is the temporary corrosion preservation during storage and transport (shipment). In this special field CORTEC VCI's offer technical and economically superior solutions in comparison with the conventional

coating-and desiccants-methods. An increasing number of important manufacturers and contract packager of corrosion sensitive parts, components, equipment, machines etc. apply CORTEC VCI's as the optimal preservation. The most significant features are:

- high effectiveness in application, also in cases with complicated preservation problems.
- a broad spectrum of application for ferrous and non-ferrous metals.
- due to a skillful combination of the different CORTEC VCI's custom tailored corrosion protection for nearly all applications.
- a considerable reduction of the costs of the system by simplification of the full packaging process.
- compliance with the environmental regulations by reducing the amount of packaging material and most importantly, the recyclability of CORTEC products.
- toxicological harmlessness of the CORTEC VCI chemistry (LD50 value ca. 1,5 g/kg rat oral).

In the center of the product line is VCI-126 film in the following designs:

- with VCI integrated mono- and coex-PE-film of all kinds (rolls, bags, shrouds etc.)
- VCI Stretch film
- VCI Coated HDPE-film

Supplementary Products are used:

- VCI impregnated foams
- VCI emitters
- VCI oil-concentrates and water based coatings

KEY **1 = recommended**
 2 = consult Cortec for specific usage
 3 = not recommended

Suggestions for the proper application are:

- the surface to be protected have to be accessible to the VCI vapors
- the surface of the metals to be protected have to be as clean as possible and must be dry
- for the maintaining of the VCI atmosphere a good quality wrapping is required

The following is a list of some typical applications for CORTEC VCI products:

OUTSIDE WRAPPING: Always use VCI-126 as a shroud plus a sheet to cover the bottom or alternatively completely wrapping in VCI-126 large width sheets.

INSIDE PRESERVATION:

- a) CorPak Film as sheets or crumpled up like VCI-papers (5 m²/m³)
- b) VCI-137 0.2 m²/m³
- c) In addition to a) and b): VCI-329 for corrosion sensitive surface (like cast-iron) and VCI-Emitters for switch boxes.

Note: To reduce the total area being protected, vacuum application is suggested.

| PRODUCT DATA SHEET VCI-III | | |
|-----------------------------------------------------------|----------------------------------|-------------------------------------------|
| FUNCTION Vapor Corrosion Inhibitor/Desiccant | APPLICATION ENCLOSURES | FORM Plastic Emitting Device |

Product Description

Cortec VCI-111 emitters are unique devices designed to provide corrosion protection for metal components and parts enclosed in non-ventilated control boxes, cabinetry, or tool boxes up to 11 cubic feet (308 liters) in volume. The VCI emits vapors which deposits a molecular layer on internal metal surfaces to protect critical, complex and expensive electronic equipment during operation, shipping, or storage. VCI-111 is a small, patented plastic emitter with a breathable Tyvek membrane through which the corrosion inhibitor is slowly released and moisture and air pollutants can enter to be absorbed. It provides long term protection against corrosion even in the presence of adverse conditions including salt, moisture, airborne contaminants, H₂S, SO₂, NH₃, and others.

Chief Advantages

- Economical to use
- Very Convenient to install
- Provides continuous Protection up to 24 months
- Effective in polluted & humid environments
- Does not interfere with electrical, optical, and mechanical surface performance
- Multi-metal performance
- Quick, easy installation
- Does not require removal
- Protects during operation and shutdown
- Non-toxic and safe to handle
- Also contains dessicant properties

- Compact, space-saving, inobtrusive device
- Free of Nitrites, silicones, phosphates
- No spraying, wiping, dipping required
- Low VOC values, meet Southern California Clean Air Act and other local regulations
- Includes internal desiccant

Typical Applications

VCI-111 can be effectively used for all operating, packaged, and stored electrical equipment, marine navigation and communication equipment, aerospace electrical controls, electric motors, switching equipment, fuseboxes, power boxes, medical equipment, electrical wireways, terminal boxes, scientific and measuring instruments, telecommunications equipment, and remote electronics devices.

Method of Application

VCI-111 is extremely simple and convenient to install. The devices should be installed at the earliest possible time, possibly even before shipping or receiving. Simply select a space within any enclosed device where corrosion protection would be useful. Verify the surface to which the device will be installed is clean and free of debris. Peel off the protective peel strip from the bottom of the device and attach it to the clean surface. The VCI-111 device can be installed in any position. For volumes greater than 11 cubic feet, install more than one device. If the enclosure is not totally air tight, or if the access doors are opened frequently, replace the VCI-111 device more often than every 2 years. After periods of heavy maintenance replace the device or spray the enclosure very lightly with Cortec VCI-238 aerosol.

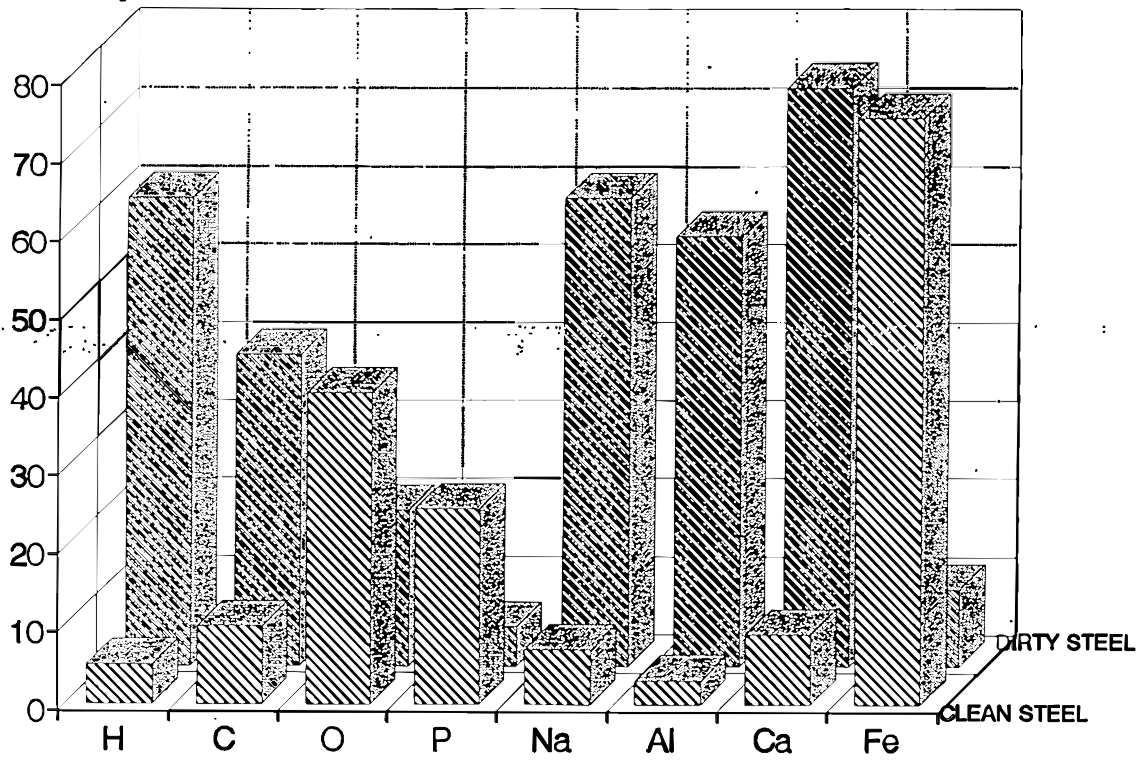
PRODUCT DATA SHEET
VCI-111

Specification

Cortec VCI-111 Plastic Emitters

| | |
|---------------------------------|------------------------------------------------------------------------------------------------------------|
| Standard Size..... | Plastic Emitter w/breathable membrane 2.3" diameter X 1.27" height 58.7 mm diameter X 21.7 mm height |
| Protection..... | 11.0 ft ³ (303 dm ³) |
| Packaging..... | 10 / carton |
| Equivalent Dessicant Units..... | 3 |

Figure 3.
Quantitative comparison of the surface contaminants on two steel samples.



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