



**Green
Packaging
Inc.**

End rust and corrosion. Guaranteed.



RUST KIT 2021

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7 CAUSES OF RUST ON YOUR METAL PARTS

- 1 Oxygen, moisture, and metal together**

Oxygen + moisture + metal = rust. That's your bottom line—and should be your guiding principle. Rust requires all three things. If you can eliminate any single one, rust is impossible. But you can't get rid of the metal when dealing with essential machinery parts. So, you need to focus on keeping moisture and oxygen at bay.
- 2 Contaminants in the air**

Airborne contaminants are tough on metal parts that sit waiting in the manufacturing area for secondary operations like machining, drilling, tapping, packaging, and shipping because they can accelerate rust and corrosion. Moisture, acidic fumes, and other byproducts from your manufacturing process can disperse into the air before landing on surfaces. Exhaust fumes from propane fork trucks—which contain chlorides, sulfides, and oxides—can add to the contaminants in the atmosphere and coat your metal parts. And if you have in-house heat-treating capabilities, the vapors, byproducts, and fumes from that process will also contribute to an environment that fosters rust and corrosion.
- 3 Improper storage or packaging**

You may be unintentionally exposing your metal parts to other materials that can cause rust. Maybe you are tossing them into reusable plastic or metal bins that have become dirty and grimy from use. Or perhaps you shipped them using products like corrugated cardboard boxes, wooden crates, or wood pallets. The dirt in storage bins can easily promote rust and corrosion. Unfinished wood can absorb moisture from the air and remain moisture-laden for a long time. And cardboard products retain chlorides and acids used to make paper products, which can speed the development of rust. Often, when metal parts come into direct contact with any wood product, you'll see "contact corrosion" and sporadic rust, where some parts in a particular shipment will be rusted while others are not.
- 4 Dirty or acidic cleaning solutions**

Metalworking fluids and cleaning solutions are a common cause of rust, especially if they are improperly maintained, dirty, or acidic. If your cleaning fluids are dirty, your metal parts will never truly be cleaned. Contaminants and dirt in the fluids can deposit on the metal's surface and inhibit the drying process. Small metal particles in your fluids—also called "swarf"—may not wash away completely, which can lead to galvanic corrosion. Improperly maintained pH levels in your cleaning solutions make them acidic, which can lead to flash rust. This is particularly important in the final rinse stage of your parts cleaning process. And if you use public water, you may be exposing your metal parts to high chlorine levels or other chemicals that can cause corrosion.



5 Fingerprints

Often overlooked, human handling of metal parts can also lead to rust. Acids, oils, and contaminants on your hands can cause and accelerate corrosion. Usually, you can clearly see fingerprints on the surface of metal parts — especially those that are highly polished or machined. Some unlucky people have a biological makeup that makes their bare hands more likely to leave a rusty fingerprint. Of course, because they're visible, fingerprints are the easiest of all root causes of rust to identify—and the easiest to solve.

6 Incomplete drying

Rust often occurs if metal parts aren't allowed to dry thoroughly after removal from cleaning and rinsing solutions. That's why, stacking your metal parts on top of each or packing them in boxes without thorough drying is a surefire recipe for rust. Wet parts—even if they look dry—will rust when they're stacked on top of each other because any fluid trapped between the parts will act as an electrolyte to form a galvanic cell. Many parts contain areas where water can pool, making them particularly susceptible to rust and requiring extra attention to ensure they dry completely.

7 Temperature fluctuations and high humidity

Failure to maintain consistent temperatures throughout your manufacturing and shipping areas can lead to rust. And, high temperatures are a catalyst for rust. In fact, corrosion rates double for every increase in temperature by 10 degrees Centigrade. Packing, storing, or shipping metal parts in plastic before they've cooled to room temperature creates condensation that promotes rust. High humidity can also cause moisture to form on the surface of your metal parts. If you package your parts in high humidity, you can inadvertently lock that atmosphere into their packaging, creating a perfect environment for rust.

7 WAYS TO PREVENT RUST ON YOUR VALUABLE METAL PARTS

- 1 Create a barrier between your metal parts and the atmosphere**

Rust and corrosion ruin millions of dollars in metal parts every year. Whenever you have metal, oxygen and moisture together, you will likely have rust and corrosion. The only way to do this is to eliminate either moisture or oxygen from reaching your metal parts. There are several effective ways to accomplish this goal. Coating your metal parts with an effective barrier such as paint, oil, or grease is a way to create this type of barrier. Additionally, powder coating or zinc galvanizing your parts will create a barrier. These methods are effective but can be costly and messy. Using desiccants which absorb moisture inside a sealed vapor barrier bag are another option, although this is very expensive, and failure will result with a simple pinhole or incomplete seal on the vapor barrier bag. VCI (Vapor Corrosion Inhibitor) packaging is also an excellent way to prevent rust without some of the disadvantages of the other methods listed above.
- 2 Protect metal parts from airborne contaminants**

Moisture, acidic fumes, and other manufacturing byproducts in the air—especially propane fork truck exhaust, manufacturing equipment fumes, and heat-treating particulates—can settle on metal parts and create and accelerate rust and corrosion. Closing bay doors when the weather is humid or rainy can help. Also try to remove your metal parts from any area in your plant where airborne contaminants and fumes are present. If that isn't practical because of the layout of your plant, you need to take a different approach. Another solution is to cover in-process metal parts with a VCI paper sheet or put them in a VCI poly bag to shield them from harmful contaminants. This is an effective and inexpensive way to prevent corrosion on expensive metal parts due to airborne contaminants.
- 3 Store and package your metal parts properly**

It's easy to unintentionally expose your metal parts to other materials that can cause rust, such as dirty plastic or metal bins, corrugated cardboard boxes, wooden crates, or even wood pallets. Just putting wood or corrugated slip sheets between layers of parts can create corrosion. The best way to prevent it is to use a barrier between your metal parts and the other material. Additionally, keeping your plastic or metal bins clean and free of contaminants will go a long way. Lining your boxes and crates with a VCI bag and covering your pallets with a sheet of VCI poly will create an effective barrier that will eliminate this type of contact corrosion.

A vertical strip on the left side of the page shows a close-up, blurred view of various metal components, likely from a manufacturing process, with different textures and shapes.

4 Maintain clean fluids and solutions
Proper cleaning, titration, and correct pH levels are necessary to keep your metal parts rust-free. Keep your metalworking fluids and cleaning solutions free of dirt and swarf. Check your fluids and solutions for contaminants regularly and ensure clean filters. Maintain the pH levels appropriate to the kind of part you're producing in all your metalworking fluids and parts washing liquids. Ferrous metal parts need a pH level of at least 9.0, and non-ferrous parts (such as copper or alloys like brass and bronze) need a pH level of 7.0–7.5. And if you use water-based metalworking liquids, use distilled or deionized water to dilute them instead of public water, which often contains chlorine or other chemicals that can cause corrosion.

5 Eliminate fingerprints
Never touch or handle metal parts using bare hands. Acids, oils, and contaminants on your hands can cause and accelerate corrosion. All employees who handle metal parts, including production workers, inspectors, and packaging personnel, should wear gloves. These gloves can be cotton, nylon, fabric, latex, rubber—any glove will work. Just make sure they're clean. Gloves are a simple solution to a common problem. So wear gloves—every time.

6 Dry parts before packing or storing
Let your metal parts thoroughly dry after taking them out of cleaning or rinsing solutions. Stacking them on top of each or packing them too soon will surely lead to rust. So, don't do it. Let your parts air dry in wire baskets before packing or storing. Vibratory action, forced air, and heat can help dry the parts more quickly.

7 Maintain constant, moderate temperature and humidity
For every 10 degrees Centigrade increase in temperature in your plant, your corrosion rates will double. Temperature changes cause metal pores to open while creating condensation. And high humidity can also cause moisture to form on the surface of metal parts. So, try to maintain consistent temperatures and low humidity throughout your manufacturing and shipping areas. Install climate controls, air conditioning, or dehumidifiers, if possible.

7 WAYS VCI CAN IMPROVE YOUR COMPANY'S IMAGE & BOTTOM LINE

- 1 Show Your Customers You Care About Their Parts**

Using the most up-to-date, cleanest, safest, and most effective methods of rust and corrosion prevention show your customers that you are concerned about the quality of their products.
- 2 Get Your Logo Printed on VCI Products to Increase Brand Visibility**

You can easily enhance your company's marketing efforts by adding your company logo and contact information to your VCI bags or VCI paper. We can even print instructions for using your product, warranty or return information—or anything else in good taste for that matter—directly on your VCI paper or bags.
- 3 Let Your Customers Know You are Environmentally Conscious**

By using VCI products instead of petroleum-based oils and greases, you show your customers that you and your company are truly green. You also eliminate the need for your customers to turn to solvents to remove oils from their parts before using them.
- 4 VCI Products Are More Affordable Than Oils, Grease & Powder Coating**

Simply put, VCI bags and VCI paper products are less costly than petroleum-based rust preventative oils and greases, powder coating, painting, galvanizing, e-coating, or phosphating. And with VCI, there is no need for expensive machinery or equipment.
- 5 VCI Wrapping Process Reduces Labor Costs**

Placing metal parts in a VCI bag or wrapping them in VCI paper is far less labor intensive than spraying, dipping, or brushing on rust preventative oils on your metal parts. Plus, there is no need for additional labor to clean up spills.
- 6 Rust Free Parts Means More Happy Customers**

When you protect your valuable metal parts with VCI paper and VCI bags, your customers will receive them in a clean, dry, rust-free condition. This helps reduce customer complaints about rusty parts and eliminates return freight costs and the need to sort and re-work rusty parts. And all that goes a long way in eliminating the need for costly and lengthy corrective action reports.
- 7 Recycling Reduces Your Disposal Costs**

VCI bags and VCI paper are recyclable, reducing your disposal costs. Moreover, using VCI for your rust prevention eliminates disposal costs of empty drums of rust preventative oil, plus disposal costs for oily rags.

7 REASONS WHY RUST PREVENTATIVE OILS ARE KILLING YOUR PROFITS, THE ENVIRONMENT & YOUR EMPLOYEES

- 1 Waste from Oil & Grease Removal Makes it into Lakes & Streams**

Preventative oils can pollute lakes, streams, and ground water. In addition, when they are applied to metal parts, hazardous solvents are required to remove the oils before using the parts.
- 2 Volatile Organic Compounds Release Harmful Contaminants into the Air**

Volatile organic compounds (VOCs), which are in many rust preventative oils, pollute the air, add particulates to it, and contribute to water pollution, air pollution, and acid rain. As a result, many municipalities limit the number of VOCs that can be emitted from manufacturing plants.
- 3 Petroleum-Based Oils Contribute to Your Company's Waste**

Reduce, Reuse and recycle are three important principles of sustainability. Reducing the number of petroleum-based oils is always a good idea. Furthermore, our VCI papers are coated on both sides which can reduce the amount of VCI paper needed. Most VCI products are also reusable unless they are soiled or torn. Most VCI products are also recyclable which is good for the environment, and means less disposal costs
- 4 Rust Preventative Oils Contain Chemicals Known to Cause Health Issues**

There are several health issues related to exposure to preventative oils, including eye, nose, and throat irritation, nausea, difficulty breathing, and damage to the central nervous system.
- 5 Many Preventative Oils Also Contain Nitrosamine a known Carcinogen**

Nitrites, amines, and heavy metals can cause skin, eye, throat, and lung irritation. Amines can combine with nitrites to form nitrosamine, a known carcinogen.
- 6 Storing Rust Preventative Oils Pose a Serious Fire Hazard**

Because they are flammable, storing rust preventative oils is a serious fire hazard. In addition, slip-and-fall accidents are common when employees use oils that are easily spilled.
- 7 Residue**

When metal parts don't fully dry, they get a sticky residue--and contaminants in the air that can cause corrosion are attracted to it.



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