

# Do You Have A Corrosion Problem?

**ZERUST®**  **EXCOR®**

**Corrosion & Cleaning Management Experts**

**Without ZERUST®**

**With ZERUST®**

# If you have a corrosion problem, we have the solution.



If you have a corrosion problem, ZERUST® has the solution. By using our proprietary ZERUST® products and proven Z-CIS® methodology, you can achieve these benefits:

- Consistent, worry-free and rust-free results during storage and shipment to end-users.
- Significant monetary savings due to reduced customer rejects, rework and scrap.
- Overall quality improvements in your manufacturing processes and supply network.



# We can solve your corrosion problems with our proven approach.

Northern Technologies International Corporation (NTIC) has nearly 50 years of on-site corrosion problem-solving experience in over 70 countries. By using our proven corrosion-solving methodology, the ZERUST® Corrosion Inhibiting System or "Z-CIS®" method, NTIC can help dramatically reduce if not eliminate your cost of corrosion.



NTIC has helped thousands of customers reduce their corrosion problems related to export shipments, storage and operations. Several large manufacturing companies have saved over \$2M USD each year by fully deploying and maintaining Z-CIS® at their manufacturing sites and supply networks.



# How much is corrosion really costing you?

Please complete as much of the worksheet below as possible in order to help estimate your **REAL** cost of corrosion.

Or visit [www.zerust.com/rustcosts](http://www.zerust.com/rustcosts) for an easy-to-use interactive tool.

Description	Code	Your Estimate	Comment
Number of products shipped per year	A		Units
Average cost of producing each product	B		Currency
Percentage of products rejected by shipment receiver due to corrosion or related quality failures	C		(%)
Percentage of rejected products unable to be salvage and must be scrapped	D		(%)
Cost of reworking each product	E		Some companies have found this to be more than 30% of the product cost when all the direct costs are taken into consideration.
Direct cost of corrosion per year (subtotal)	F		$F = (A \times B \times C \times D) + [A \times C \times (1-D) \times E]$
Indirect cost of corrosion per year, maintenance of additional inventory, lost freight, warehousing, repacking and handling, production halts, air freight charges, personnel, etc.	G		Some companies have found this to be more than 15% of the direct cost of corrosion calculated above. $G = F \times 0.15$
<b>Your total direct and indirect cost of corrosion PER YEAR</b>	H		$H = F + G$
<b>Your total direct and indirect cost of corrosion PER DAY</b>	I		$I = H \div 255$

Through our Z-CIS® corrosion-solving methodology and products, ZERUST® can help you reduce your total cost of corrosion by 10% or more.

# Have you experienced corrosion or corrosion-related problems?



## **Shipment Rejections:**

Product shipped overseas arrives at the customer rusted, resulting in the shipment being rejected.

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## **Production Delays:**

Production tools left in inventory rust beyond a usable state by the time they are needed.

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## **Equipment Failures:**

Electrical control panels and electronic equipment stop functioning.

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## **Costly Repairs and Production Downtime:**

Structural failures affect production and product quality, resulting in costly repairs or replacements.

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## **Health and Environmental Concerns:**

Inefficient corrosion protection methods are expensive to remove, are difficult to dispose of, and contaminate the workplace and the environment.

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## **Costly Rework:**

Any additional rust removal and parts rework can add significant costs.

# Z-CIS®: Our proven unique methodology for solving your corrosion problems.

The ZERUST® Corrosion Inhibiting System (Z-CIS®) is the proven methodology for deploying the complex corrosion management systems necessary to ensure the protection of metal products. It addresses causes of corrosion at each stage of **product handling, in production** and **in transit** around the world, as the product travels among multiple internal and external stakeholders. Z-CIS® is proven to meet both the rust-free and contaminant-free requirements of various OEMs sourcing from a global supply base. After implementing Z-CIS®, our clients generally realize total cost savings of at least 10% and rust-free shipment yields as high as 100%.

To get started visit [www.zerust.com/tellus](http://www.zerust.com/tellus)



**Product Handling**



**In Production**



**In Transit**

# ZERUST® Z-CIS® – The ZERUST® Corrosion Inhibitor System

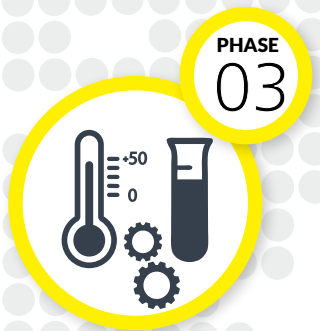
Our Proven Process for Managing and Solving Corrosion Issues



- **All entities involved** in your supply chain (internal and external) affected directly or indirectly by corrosion concerns are identified as stakeholders and contacted by a ZERUST® Representative.
- Each entity completes a **Z-CIS® Questionnaire** ([www.zerust.com/tellus](http://www.zerust.com/tellus)) either independently or in the course of a phone interview, so the ZERUST® Corrosion Engineering Team can properly understand all potential root causes of corrosion at the start of the project.



- **The ZERUST® Team reviews** the project scope, corrosion control system performance requirements and critical issues with all stakeholders.
- The **Z-CIS® Deployment Proposal** is distributed. This document outlines the work that the ZERUST® Team would need to perform, the cost associated with the project, our initial recommendations and any additional items/information required from the stakeholders.
- Key stakeholders review and sign-off on the Z-CIS® Deployment Proposal, authorizing the ZERUST® Team to start work.



- **The ZERUST® Team collects** product samples from the manufacturing site, draws samples of all processing fluids from the production line, evaluates the climatic stress impact of the shipping route, updates process FMEA documents, reviews process control plans, etc.
- Products and fluid samples are tested in one of our regional laboratories located around the world for corrosion management system compatibility.
- The ZERUST® Team recommends a corrosion protection system (several recommendations may be generated) in the **Z-CIS® Deployment Recommendations** document.



- **A meeting is required** with all stakeholders to agree on the corrosion protection system to be deployed.
- The ZERUST® Team works with the organizations directly involved in the process change (if any) to deploy the recommended solution. The corrosion protection system is executed in a viable time frame.
- Trial shipments are made and monitored to ensure that the new Z-CIS® Plan is working properly.



- **Regular audits** are conducted to ensure that the process remains in control and improvements are implemented according to the **Z-CIS® Deployment Recommendations**.

# What is Integrated Corrosion Technologies (ICT®)?

ZERUST® Integrated Corrosion Technologies (ICT®) is our term for the various materials and chemical sciences that comprise our products. Depending on corrosion protection requirements and economic targets, the following combinations of ICT® Products can be designed to create the optimum corrosion protection system.

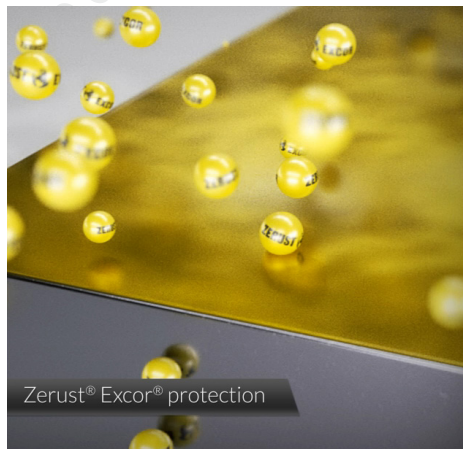
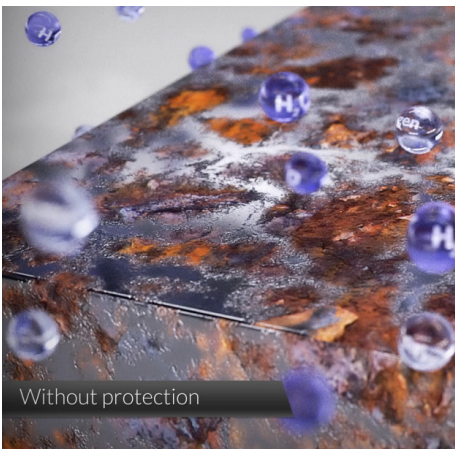
**Physical material design and selection.** The ZERUST® Team will help you select the optimal packaging material and design to meet your corrosion protection needs. The material may vary from barrier film, to a low density polyethylene, depending on economic targets and performance requirements.

**Chemical scavenging technology.** Depending on the corrosivity of the environment, the ZERUST® Team may also incorporate our patented chemical scavenging technology into the selected base packaging material to neutralize any acid gases and prevent them from coming in contact with metal components sealed inside the package.

**Chemical passivation technology.** This technology is generically referred to in the industry as volatile or vapor corrosion inhibiting (VCI) technology. ZERUST® chemical passivation technologies are proprietary formulations that are based on non-toxic food additives. They only activate in direct response to the corrosivity of the immediate environment. The ZERUST® chemical molecules are deposited from the ZERUST® corrosion products onto metal surfaces and form a powerful molecular layer that passivates these metal surfaces and protects them from corrosion. This layer is invisible and dry, and does not affect the physical properties or functionality of the metal in any way. The protected metal can be painted, treated and/or used straight out of the ZERUST® Package without further cleaning.

**The total solution.** We offer comprehensive solutions for your entire supply chain and manufacturing process that help you achieve your corrosion protection objectives and cost targets. Additional examples of Integrated Corrosion Technologies® include void protection diffusers, rust preventative coatings and hard-working rust removers. These solutions are tested to work together for total corrosion control.

## Total Corrosion Control.

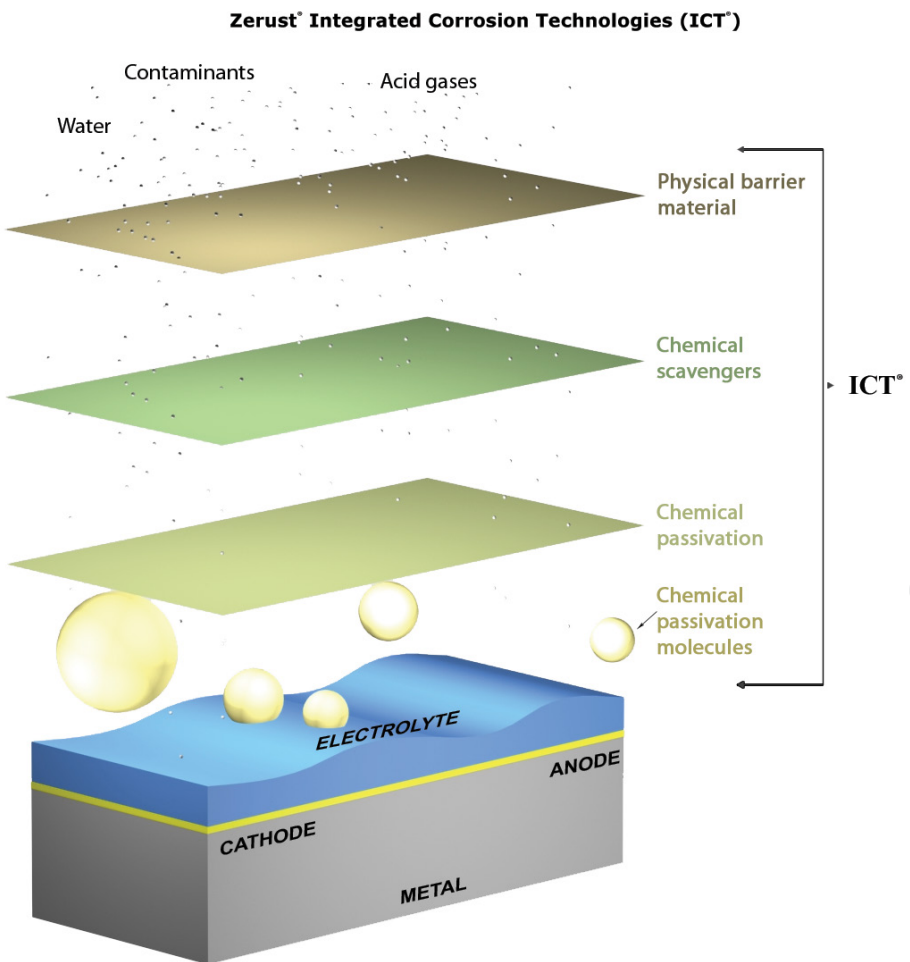




# How does ICT<sup>®</sup> work?

## ZERUST<sup>®</sup> ICT<sup>®</sup> prevent corrosion in several ways.

1. By acting as a protective barrier from external dirt and abrasion, and also as a barrier to help block the diffusion of corrosive acid gas pollutants from outside and inside the ICT<sup>®</sup> packaging (such as sulfur dioxide or hydrogen sulfide)—thereby preventing contact between these corrosive gases and the enclosed metal surfaces.
2. By emitting vapor corrosion inhibitors that passivate the electron flow between the anodic and cathodic areas on metal surfaces and interrupt the electro-chemical corrosion process.
3. By depositing a hydrophobic molecular layer and thereby inhibiting water from reaching the metal surfaces and forming the electrolyte necessary for corrosion reactions.



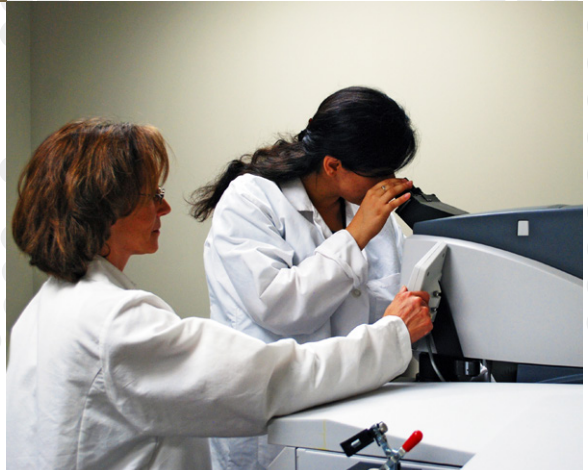
# Laboratory testing and analysis.



With the aid of our team of specialists from one or more of our multiple analysis and research laboratories worldwide and network of external independent testing centers, we are able to identify the source and species of corrosive elements causing your corrosion problem. This allows for faster testing turnaround times and accurate analysis of results.

## Make sense of test data.

General purpose laboratories can analyze components and process fluid specimens, but they lack the experience garnered by decades of work focused on accurately translating test results into actionable initiatives that will aid to resolve corrosion problems.



## Corrosion control management services.

**Outsource your corrosion concerns** to us. We are able to help you establish the most efficient and economic corrosion control system for you and your supply chain. We are also able to manage the corrosion control system to ensure compliance and a consistent outcome.





# Global account management support.



**ZERUST® Account Managers** are experienced individuals who work across multiple countries to ensure that your supply chain, shipments and product movements are performing effectively in accordance to the deployed Z-CIS® Plans. These Account Managers will supervise the Z-CIS® Deployment Projects from start to finish. This ensures all organizations and people work together seamlessly to produce the desired results in corrosion control management. This lets you relax and focus on your priorities while leaving the deployment of an effective corrosion control management system to ZERUST®.

**Some corrosion control roles that the ZERUST® Account Managers may perform are:**

- Corrosion incident investigations
- Shipment inspections
- Pack design reviews
- Production part approval process
- Problem-solving team participation
- Work instruction review and/or documentation
- Operator training
- Z-CIS® Deployment Project Management throughout your supply chain
- ZERUST® Product Supply Management

## Customized solutions.

**If you have a unique corrosion challenge**—ZERUST® can develop custom products and services to fit your needs. ZERUST's multiple laboratories worldwide, global network of experts, and relationships with key universities will bring you a step closer to the ideal product or technology.

# The ZERUST® Product Line

## ICT®400 Series: VCI Kraft Packaging Paper

Acid-free, pH neutral corrosion inhibiting paper and poly-laminated paper offer short-term corrosion protection for metal parts.

### Products Include:

ZERUST® ICT®420 VCI Kraft Paper (30#,35#, & 60#)  
ZERUST® ICT®420-35P VCI Kraft Poly Paper  
ZERUST® ICT®427 VCI Kraft Paper  
ZERUST® ICT®430-35PCR VCI Poly Coated Kraft Paper  
ZERUST® ICT®432-35P Poly VCI Kraft Paper



ZERUST® polyethylene films and most ZERUST® paper products are recyclable. Please consult local, state and federal regulations.



## ICT®500 Series: Packaging Films

Our most widely used series of products. A variety of films offer short or long-term corrosion protection for parts and equipment during storage or shipment.

### Products Include:

ZERUST® ICT®504-LM Moisture-Limiting Film  
ZERUST® ICT®510-C Ferrous Film  
ZERUST® ICT®510-C Non-Ferrous Film  
ZERUST® ICT®510-C Multimetal Film  
ZERUST® ICT®510-CLHD High Density Film  
ZERUST® ICT®510-OPS Outdoor Shrink Film  
ZERUST® ICT®510-SRK Shrink Film  
ZERUST® ICT®510-SK Skin Film  
ZERUST® ICT®510-SM Stretch Film  
ZERUST® ICT®520-CB1 Anti-tarnish Film  
ZERUST® ICT®520-CSL Cold Seal Film  
ZERUST® ICT®520-HS High-Strength Film  
ZERUST® ICT®520-XF Ultra Tear-Resistant Film  
ZERUST® ICT®520-PV Film  
ZERUST® ICT®520-SRA VCI Plastic Scrim  
ZERUST® ICT®540-SDA Film  
ZERUST® ICT®570 VCI Foam Sheeting  
ZERUST® ICT® Closed Cell VCI Foam  
ZERUST® ICT® VCI Bags  
ZERUST® ICT® VCI Tote Covers  
ZERUST® ICT® Weapon Protection Bags  
ZERUST® Natur-VCI® Compostable VCI Film



ZERUST® polyethylene films and most ZERUST® paper products are recyclable. Please consult local, state and federal regulations.



## ICT®600 Series: Rust Removers

Highly effective for light to severe rust removal. All ICT®600 Series Cleaners are non-toxic, non-hazardous and non-corrosive.

### Products Include:

ZERUST® AxxaClean™ 2048 Medium Rust Remover  
ZERUST® AxxaClean™ 3048 Heavy Rust Remover

## ICT®630 Series: Cleaners & Degreasers

Low foaming\* aqueous cleaner and degreaser products that are specifically designed to quickly and effectively remove hydrocarbon soils.

### Products Include:

ZERUST® AxxaWash™ KF-121 Cleaner  
ZERUST® AxxaWash™ KF-123 Cleaner/Flash-Rust Inhibitor  
ZERUST® AxxaWash™ KF-124 Cleaner/Flash-Rust Inhibitor  
ZERUST® AxxaWash™ KMS-220 Cleaner/Flash-Rust Inhibitor  
ZERUST® AxxaWash™ NW-10C Cleaner/Flash-Rust Inhibitor  
ZERUST® AxxaWash™ NW-12C Cleaner/Extended Flash-Rust Inhibitor



## ICT®700 Series: Corrosion Inhibitor Coatings and Additives

Temporary corrosion protection for parts in-between production processes or in storage, as well as for added protection to the ICT®500 Packaging Products during ocean shipments.

### Products Include:

ZERUST® Axxavis™ PX-05 AN Powder Additive  
ZERUST® Axxavis™ PX-10 HRD Powder Additive  
ZERUST® Axxavis™ HST-10 Powder Additive  
ZERUST® Axxatec™ 8110C Water-Based Additive  
ZERUST® Axxatec™ 30C Water-Based Inhibitor Coating  
ZERUST® Axxatec™ 77C Water-Based Inhibitor Coating  
ZERUST® Axxatec™ 80C Water-Based Inhibitor Coating  
ZERUST® Axxatec™ 85-F Water-Based Inhibitor Coating  
ZERUST® Axxatec™ 87-M Water-Based Inhibitor Coating  
ZERUST® Axxanol™ 33 Oil-Based Coating  
ZERUST® Axxanol™ 33CD Solvent-Based Coating  
ZERUST® Axxanol™ 34CD Solvent-Based Coating  
ZERUST® Axxanol™ A35CD-32 Solvent-Based Coating  
ZERUST® Axxanol™ A35CD-7 Solvent-Based Coating  
ZERUST® Axxanol™ 718-ESS Solvent-Based Electric Spray  
ZERUST® Axxanol™ 750 VCI Oil Coating  
ZERUST® Axxanol™ 750-NV Oil-Based Coating  
ZERUST® Axxanol™ 46-BIO Biobased Preservative Coating  
ZERUST® Axxanol™ Spray-G Sprayable Grease  
ZERUST® Axxanol™ Z-Maxx LV Rust Preventative Grease  
ZERUST® Axxanol™ Z-Maxx Rust Preventative Grease  
ZERUST® Axxanol™ 707C & 710C VCI Oil Additives  
ZERUST® AxxaCoat™ 90B HFS Outdoor Rust Preventative



## ICT®800 Series: VCI Diffusers

Self-contained, portable products that diffuse ZERUST® ICT® protective vapors. The vapors saturate enclosures, such as shipping containers and electrical boxes, to protect metals from corrosion.

### Products Include:

ZERUST® ICT® Vapor Capsules  
ZERUST® ICT® Plastabs®  
ZERUST® ICT® Cor-Tab®  
ZERUST® ICT® Pipe Strip™  
ZERUST® ICT® Tube Strip™  
ZERUST® ICT®810-OC VCI Foam Pad  
ZERUST® ICT® ActivPak® Flash-Corrosion Inhibitor  
ZERUST® ICT® ActivDri™ Capsule  
ZERUST® ICT® ActivCapsule™  
ZERUST® ICT® ActivTab™(LS)  
ZERUST® ICT® ActivPowder™ Flash-Corrosion Inhibitor  
ZERUST® Z-Pak® VCI Packets  
ZERUST® Vapor Capsule ZAK-M22  
ZERUST® ICT® Tube Strip Pro



Products are subject to change and availability

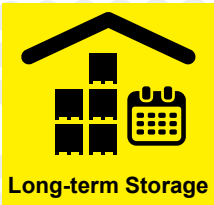
# Solutions for every application.

With our wide range of ZERUST® Products, we augment Z-CIS® Deployment Services to achieve the optimum corrosion management systems for your manufacturing sites and supply network. This provides consistency and control in the deployed corrosion management system—we control the tools (ZERUST® Products) to ensure a positive outcome.



**ZERUST® has decades of experience protecting parts** and equipment as they are transported around the world: with outstanding results. Upon implementing our solutions, our clients have achieved up to 100% rust-free shipments.

**Some products used for Export Shipment applications include:**  
ZERUST® ICT®510-C Film • ZERUST® ICT®520-XF Film  
ZERUST® Axxanol™ 33CD Coating • ZERUST® Axxanol™ 750 VCI Oil RP



**Parts and equipment that need to be stored for long periods** have their own challenges, especially when climate control is not possible. Relax. With ZERUST®, we help ensure that parts stay corrosion-free for the duration of their storage time.

**Some products used for Long-Term Storage applications include:**  
ZERUST® ICT®510 Film • ZERUST® ICT®520-HS Film • ZERUST® Z-Maxx Coating



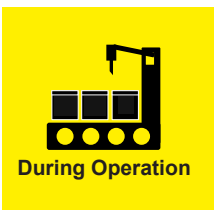
**Don't risk valuable inventory** corroding while it awaits use. Protect it with ZERUST®. ZERUST® products are quick and easy to use—simply pack and store.

**Some products used for Inventory Storage applications include:**  
ZERUST® ICT®510-SM Film • ZERUST® ActivPak™ Flash Corrosion Inhibitors  
ZERUST® Axxatec™ 77C Coating • ZERUST® ICT®420 VCI Kraft Paper



**Corrosion can strike just about anywhere.** Protect the integrity of your assets with solutions from ZERUST®. ZERUST® can help you decrease scrap rates and increase productivity.

**Some products used for Work in Progress applications include:**  
ZERUST® Axxaclean™ Rust Remover Series • ZERUST® ICT® Tote Covers •  
ZERUST® ActivPak™ Flash Corrosion Inhibitors



**ZERUST® has solutions for items that need protection** during actual operation. From electrical control boxes and engine housings to entire crude oil storage tanks, ZERUST® solutions prevent failures and minimize downtime to save you money.

**Some products used During Operation applications include:**  
ZERUST® ICT® Vapor Capsules • ZERUST® ICT® Plastabs® • ZERUST® ActivPak™  
Flash Corrosion Inhibitors • ZERUST® ReCAST • ZERUST® Flange Saver™

To find out more about ZERUST® Products that are right for your application, please visit [www.zerust.com/products](http://www.zerust.com/products)

# Proof positive that **ZERUST®** solutions perform.

With nearly 50 years of corrosion management experience and a global distribution and technical network of joint ventures representing over 70 countries, ZERUST® is the leader in innovative corrosion prevention solutions and has helped over 5,000 clients save money, improve product quality and reliability, reduce negative environmental impact and improve customer satisfaction.

## Applications



### Automotive

ZERUST® has been deployed by almost all major automotive companies and their automotive parts suppliers. Our sales directors are experts in corrosion solutions for work-in-progress, packaging, shipping, storage, and inventory applications.



### Electronic Rust Prevention

ZERUST® corrosion inhibiting packaging products are a cost-effective way of protecting electrical and electronic components and equipment from the destructive effects of corrosion.



### Marine

Corrosion damage is especially prevalent in marine applications, where a constant salt air environment—often combined with high temperature and humidity levels—increases the threat of corrosion. ZERUST® has extensive experience in protecting in these highly corrosive environments.



### Military

ZERUST® has extensive experience in corrosion prevention and remediation for the military. Many ZERUST® products conform to Mil Specs, have NSN numbers, and are actively used by members of the armed forces.



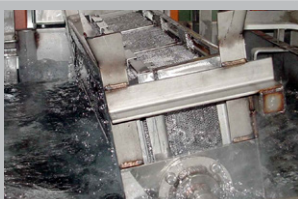
### Outdoor Storage and Long Term Protection

ZERUST® offers complete corrosion inhibiting solutions for the outdoor preservation and long term storage of metal assets.



### Surface Cleaning and Rust Removal

ZERUST® offers powerful rust remover solutions for rework and recovery of metal assets. With spray, immersion and brush-on applications ZERUST® has the solution to your corrosion problem.

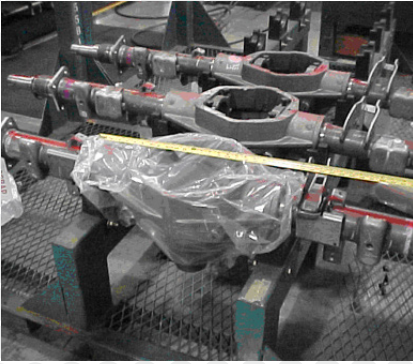


### Part Washing

ZERUST® AxxaWash™ Industrial Cleaners & Degreasers are part washer fluids that feature low foaming aqueous-based products designed to quickly and effectively remove light to medium-duty hydrocarbon soils typically encountered in metalworking operations.



# Case studies.



ZERUST® ICT®520-CSL Film protecting a differential unit during service shipment.

## ZERUST® ICT®520-CSL Film saves packaging time.

**Problem:** An automotive parts manufacturer needed a faster way to protect parts during service and interplant shipment.

**Solution:** ZERUST® ICT®520-CSL Cold Seal Film eliminated the need for a heat sealer or other closure methods and saved the client 75% in packaging time—all while providing outstanding corrosion protection.



An electrical box protected internally by ZERUST® ICT® Vapor Capsules and externally by ZERUST® ICT®510-C Film.

## ZERUST® vs. Desiccant-Barrier packaging.

**Problem:** An international crating company wanted to replace their desiccant-barrier corrosion prevention method with a more effective, longer-lasting solution.

**Solution:** ZERUST® ICT® Vapor Capsules and ZERUST® ICT®510-C Ferrous Film provide corrosion protection for years\*. In this case, ZERUST® successfully protected the client's shipment of factory equipment while it was stored outside for one year. And the total cost of the ZERUST® materials was 57% less than the desiccant-barrier packaging method.



A bail-out pump motor protected by a ZERUST® ICT®510-C Ferrous Bag. Pump is corrosion-free and ready to use.

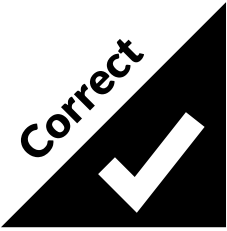
## ZERUST® protects marine equipment in highly aggressive environments.

**Problem:** A major naval organization was facing severe corrosion issues in their aids to navigation, bail-out pump motors and small engines.

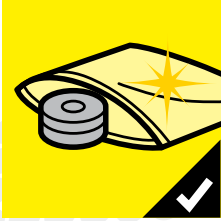
**Solution:** ZERUST® Vapor Capsules and ZERUST® ICT®510-C Ferrous Film helped the organization significantly reduce their corrosion, which in turn improved the equipment's reliability and the organization's operational readiness.

Case studies are also available online at [www.zerust.com/resources/case-studies](http://www.zerust.com/resources/case-studies)

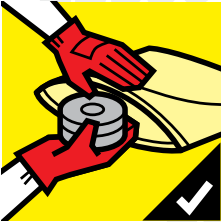
# How to use ZERUST® ICT® packaging material.



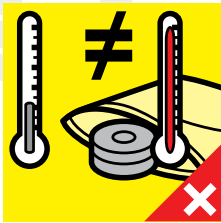
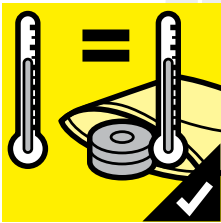
## Instructions For Use



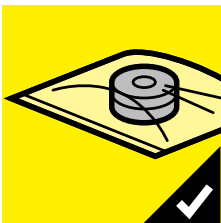
Pack only clean and dry parts.



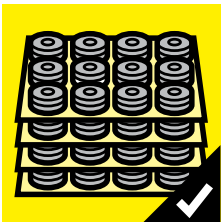
Always wear clean and dry gloves when handling metal parts to protect them from corrosion causing fingerprints.



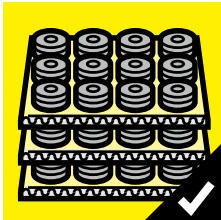
When packing, the temperature of the parts should be near room temperature to avoid condensed moisture.



Tightly close packages with tape, heat seal, zip ties or by folding over. Reseal after every use.



Insert additional ZERUST® materials as interleave for added protection in larger and tightly packed or layered packages.



Avoid direct contact of metal with wood, paper or cardboard (sources of moisture and acid).

# NTIC's commitment to health and safety.

ZERUST® is committed to making safe and effective products. Our products help to reduce industry's impact on the environment by extending material life and reducing the waste and energy associated with rework or producing new metal items. A number of our products are biodegradable or recyclable.

Since 1979, ZERUST® ICT® Products have been used by more than 5,000 companies and 200,000 people worldwide, with many of them being long-term customer relationships spanning 20+ years.

NTIC has been featured on the PBS program, "American Environmental Review," in recognition for being one of the key contributors of advanced technologies that have made a significant positive impact on the earth's environment.\*

ZERUST® ICT® Products have been cleared by the U.S. Food and Drug Administration for use in protecting metal food containers and processing equipment.\*

ZERUST® ICT® Products have also been approved by the toxicology departments of various automotive companies. For example:

## **Toxicology Numbers:**

GM (US): 212 149

GM (Canada): 319 146

Chrysler (US): 35 692 1380

TDS (US): 95801

## **Ford (US) Toxicology Numbers - Product Specific:**

ZERUST® High Strength Multimetall Film: 154 032

ZERUST® Ferrous Film: 041 388

Axxanol™ 33CD: 170 722

Axxanol™ 33: 17592

ZERUST® ICT®520-FD Film with Flame Retardant: 178 305

## **Ford (Brazil) Toxicology Numbers - Product Specific**

ZERUST® Cushioning Film MM Version: 180 671

ZERUST® High Strength Film MM Version: 180 959

ZERUST® ICT® VC2-2 Vapor Capsule: 180 958

## **Product Approval Numbers:**

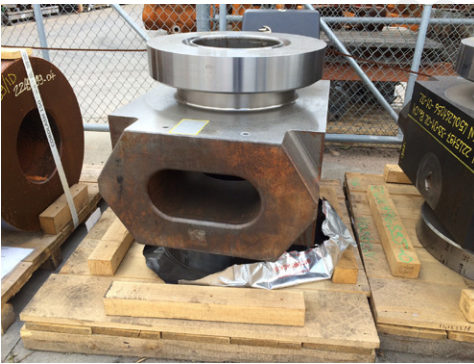
Toyota: Y0212-01003 (ZERUST® Ferrous Sheeting, Size 1)

Toyota: Y0212-01005 (ZERUST® Ferrous Sheeting Size 2)

\*Copies of reports are available upon request.

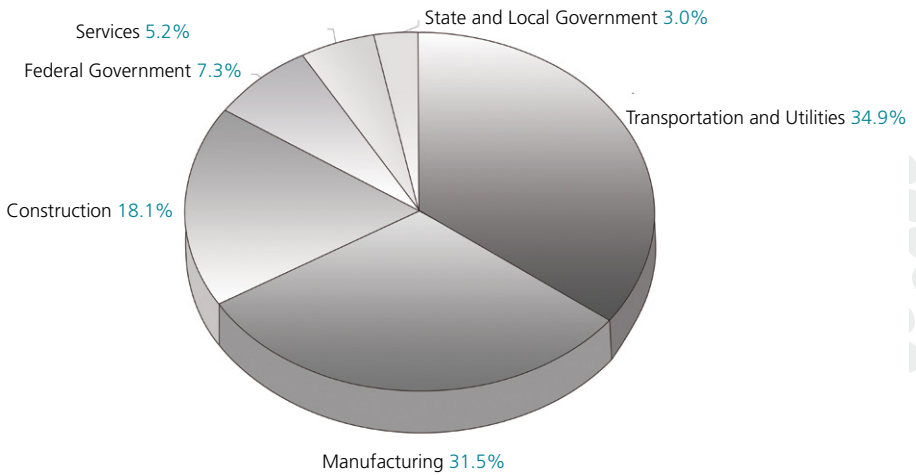
# General Corrosion Information

**What is corrosion?** Corrosion is the chemical or electrochemical reaction between a metal and its environment that results in deterioration of the material and its properties. Corrosion is generally initiated when atmospheric moisture (humidity) settles on metals. This moisture acts as a conductor, enabling the flow of electrons between high-energy areas (cathodes) and low-energy areas (anodes) on metal surfaces. This electrochemical process results in the visible oxidation referred to as rust (iron, steel), white rust (galvanized steel), and some other terms for corrosion such as tarnish, pitting, flaking and spalling.



# Cost of Corrosion in the United States of America:

## \$2.5 trillion, 3.4% of GDP\*



\* INTERNATIONAL MEASURES OF PREVENTION, APPLICATION, AND ECONOMICS OF CORROSION TECHNOLOGIES STUDY, Report by NACE International, International Measures of Prevention, Application, and Economics of Corrosion Technologies (IMPACT), March 1, 2016.

### Types of corrosion.

There are many different types of corrosion, including atmospheric corrosion, corrosion in waters, corrosion in soils, corrosion in chemical environments, mechanically assisted corrosion, high-temperature corrosion, and microbiologically influenced corrosion. From an economic, safety and aesthetic standpoint, atmospheric corrosion is the most notable type of corrosion. Atmospheric corrosion is enabled by atmospheric humidity and stimulated by pollutants such as acid gases [sulfur dioxide ( $\text{SO}_2$ ), hydrogen sulfide ( $\text{H}_2\text{S}$ ) and carbon dioxide ( $\text{CO}_2$ )], nitrogen oxides ( $\text{NO}$  and  $\text{NO}_2$ ), ozone ( $\text{O}_3$ ) and salts (chlorides and sulfides).



### How corrosion is prevented.

Corrosion can be prevented by modifying the atmosphere through dehumidification, nitrogen purge, and evacuation. Another method is by creating a protective barrier on the metal surface against moisture. This barrier can be formed by a liquid coating, such as oil, or via packaging products that work by diffusing corrosion inhibiting molecules from the packaging into the air. These molecules settle on metal surfaces and form a protective corrosion inhibiting layer that inhibits the electrochemical reactions that cause corrosion to form.

ZERUST® combines the use of proprietary vapor corrosion inhibitor formulas augmented with acid gas scavengers and other chemical enhancements and process management expertise to implement custom corrosion solutions for a customer or throughout an entire supply chain. We call this our ZERUST® Integrated Corrosion Technologies (ICT®).

# How to get started solving your corrosion problems.

**It's time to put an end to the frustration** and worry that corrosion problems have caused your company. In order for the ZERUST® Team to help you solve your corrosion problem as quickly and effectively as possible, we ask that you take the following steps:

- Complete and submit the Z-CIS® questionnaire found online at **[www.zerust.com/tellus](http://www.zerust.com/tellus)**
- Take as many photos as possible of the corroded product and its packaging.



- A ZERUST® Engineer will contact you within two business days of receipt. If you need urgent attention, please contact us at 1-763-225-6600 or [sales@zerust.com](mailto:sales@zerust.com).



# Company Overview

Northern Technologies International Corporation (NTIC) is in the business of converting unique, environmentally beneficial materials science into value-added products and services for industrial and consumer applications.

NTIC was founded in 1970 in Lino Lakes, Minnesota with its primary business in oil analyzer instruments (then known as Northern Instruments, Inc.). In 1993, Northern Instruments changed its corporate name to Northern Technologies International Corporation. The company has since grown out of the oil analyzer instrument business and into a global provider of corrosion inhibiting products and corrosion control management services with sales and technical support in more than 70 countries.

Consistent with our desire to expand our offering of clean, environmentally beneficial technologies, we have developed patented compostable plastics and renewable resource engineered plastics to further reduce any impact on the environment.

## Worldwide support.

Our Global Federation of internationally recognized scientists and field engineers provide worldwide point-to-point, on-site technical support to our clients. Whether it be application recommendations, shipment inspections, system audits, troubleshooting or general support. Our network reaches over 70 countries to support your business.

Algeria	Denmark	Mexico	Spain
Angola	Ecuador	Monaco	Sri Lanka
Argentina	Estonia	Morocco	Sweden
Australia	Finland	Nepal	Switzerland
Austria	France	Netherlands	Taiwan
Bangladesh	Gabon	Nigeria	Thailand
Belarus	Germany	Norway	Tunisia
Belgium	Hungary	Peru	Turkey
Bhutan	India	Philippines	Ukraine
Bolivia	Indonesia	Poland	United Arab
Brazil	Ireland	Portugal	Emirates and
Canada	Italy	Republic of	MENA
Chile	Japan	Congo	(Middle East &
China	Kazakhstan	Romania	North Africa)
Colombia	Korea	Russia	United Kingdom
Czech Republic	Latvia	Singapore	United States
Democratic	Lithuania	Slovak Republic	Uruguay
Republic of the	Luxembourg	Slovenia	Vietnam
Congo	Malaysia	South Africa	

## Technology platforms.

**ZERUST<sup>®</sup> EXCOR<sup>®</sup>**

Worldwide leader in corrosion prevention and management products and services.

[www.zerust.com](http://www.zerust.com)

**Natur-Tec<sup>®</sup>**

Proprietary biobased and biodegradable plastics and products tailored for single-use disposable consumer and industrial packaging, and durable industrial engineered plastics applications.

[www.natur-tec.com](http://www.natur-tec.com)

**Zerust<sup>®</sup> OIL & GAS**

Zerust<sup>®</sup> Oil & Gas provides corrosion mitigation solutions and services to clients in the Oil & Gas and process chemical industries.

[www.zerust-oilgas.com](http://www.zerust-oilgas.com)



**ZERUST®**  **EXCOR®**

**Corrosion & Cleaning Management Experts**

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### ‡ DECLARATION

Corrosion protection claims are based on Northern Technologies International Corporation (NTIC) internal laboratory testing performed under controlled parameters on contaminate-free substrates. Real-world application corrosion protection duration on different substrates will vary and depends on factors such as, but not limited to, the application or use, environmental / storage conditions, surface cleanliness, type of substrates, and coating thickness (where applicable). The use of the term "Up to" in reference to time is defined as any time duration from zero up to a specified time frame, but in no event beyond the specified time frame. The use of the term "for years" is based on NTIC's experience with its products but is in no way guaranteed. The use of the term "Up to" in reference to volume is defined as any volume from zero up to a specified volume but in no event beyond the specified volume of protection. It is the customer's / user's obligation to evaluate product performance, corrosion protection duration, safety, and suitability for intended use within the scope advised in the data sheet and to comply with all applicable laws and regulations. **LIMITED WARRANTY/DISCLAIMER** Warranty is limited to the replacement of a product that fails to meet specifications. For full warranty and disclaimer information, visit [www.zerust.com/warranty](http://www.zerust.com/warranty).

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