ZERUST® EXCOR®

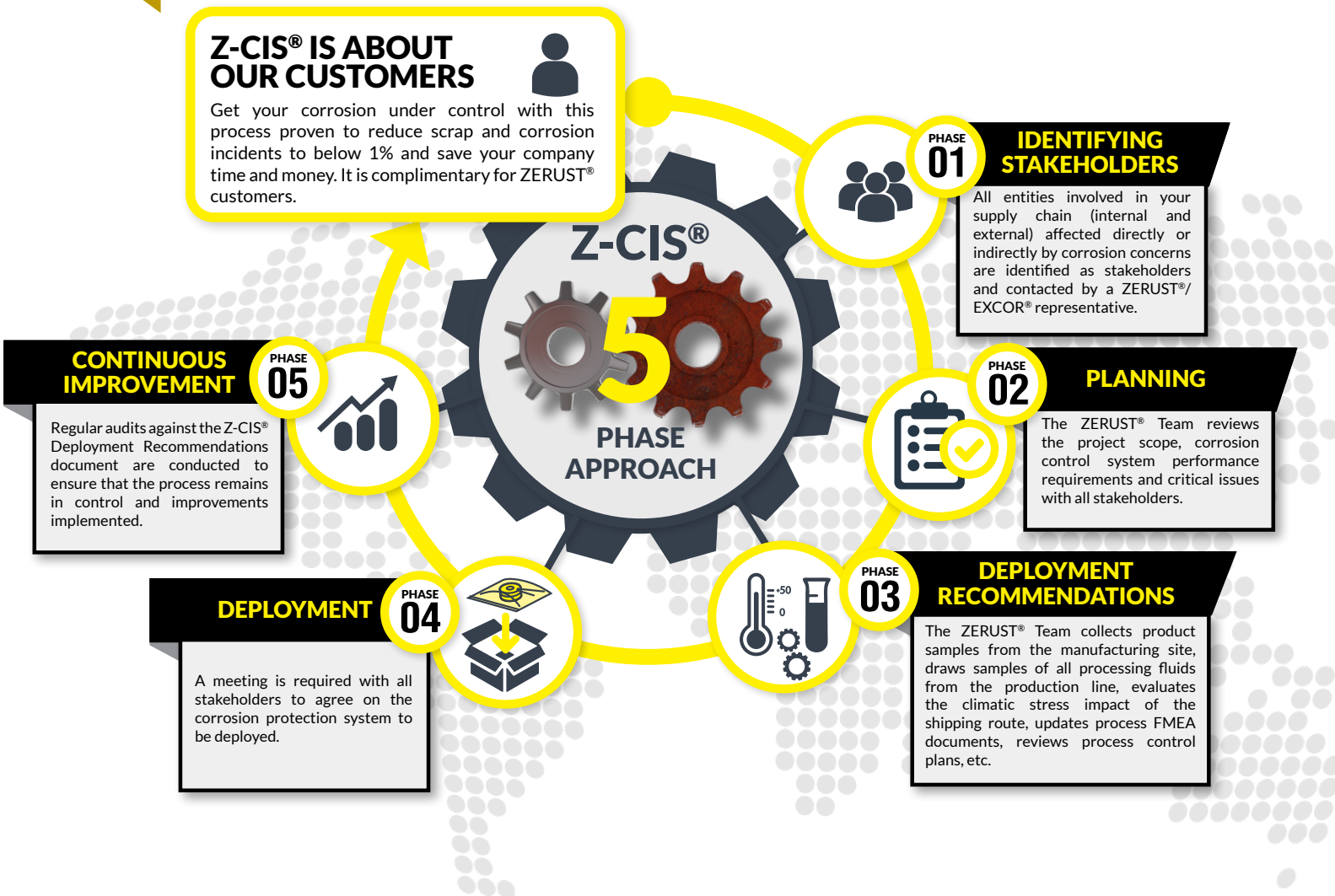
ZERUST®/EXCOR® Global Corrosion Management Solutions

LAB & TECHNICAL SERVICES

www.zerust.com
1-763-225-6600

The ZERUST® road map to managing corrosion

We know that you are busy. That's why we designed the Z-CIS® project management system to allow you to stay in control during every phase of a Z-CIS® deployment. Z-CIS® is the proven **Z**ERUST® **C**orrosion **I**nhibitor **S**ystem methodology for deploying programs necessary to ensure the protection of metal product shipments in transit around the world. It works with the complex multiple internal and external entities involved in every part of the supply chain. Z-CIS® is proven to meet the rust-free and "smoke-free" requirements of various OEMs sourcing from a global supply base. After implementing a Z-CIS® system, our clients generally realize total cost savings of at least 10% and rust-free shipment yields as high as 100%.
Visit, **www.zerust.com/zcis** to learn more.



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Cyclic Chamber Test
(Standard: IEC 60068-2-30)

Purpose: To determine the rate of corrosion of a test specimen (components coated with fluids, or packaged in material) through accelerated fluctuating climatic conditions in a chamber. The rate of corrosion provides an estimated time to first appearance of corrosion on the test specimen.

Description: Testing of a specimen (components coated with fluids, or packaged in material) in a cyclic temperature and humidity chamber in accordance to IEC 60068-2-30 for 15 days. Results will be sent via email and mail to client at the end of testing.

Estimated time frame of testing*: 25 days

Salt Spray Chamber Test
(Standard: ASTM B117)

Purpose: This practice provides a controlled corrosive environment which is utilized to produce relative corrosion resistance information for test specimen (components coated with fluids, or packaged in material) exposed in test chamber.

Description: Testing of a specimen (components coated with fluids, or packaged in material) in a salt spray chamber in accordance to ASTM B117. Results will be sent via email and mail to client at the end of testing.

Estimated time frame of testing*: 42 days

**Time starts from the day NTIC receives the sample(s). Test duration is an estimate and depends on when the test sample shows signs of corrosion in the chamber.*

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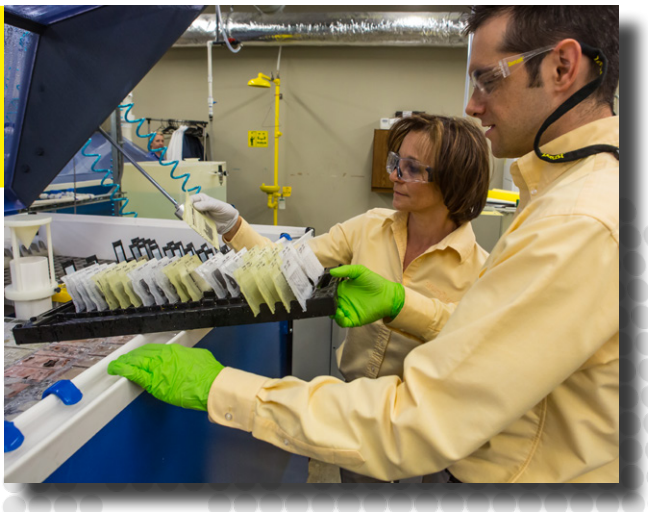
Humidity Chamber Test
(Standard: ASTM D1735)

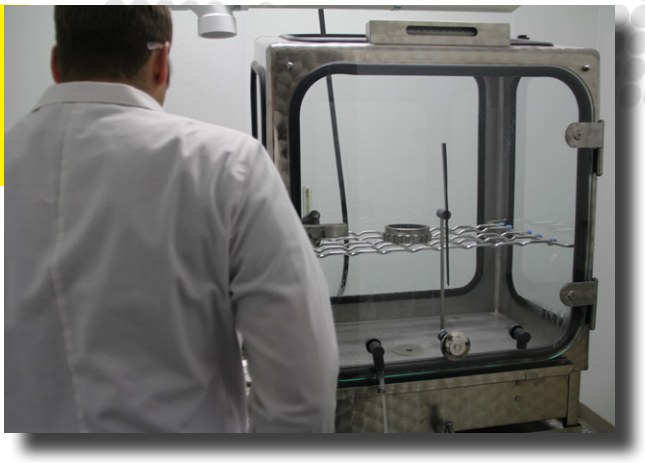


Purpose: To determine the rate of corrosion of a test specimen (components coated with fluids, or packaged in material) through accelerated climatic conditions in a chamber. The rate of corrosion provides an estimated time to first appearance of corrosion caused by the test specimen.

Description: Testing of a specimen (components coated with fluids, or packaged in material) in a humidity chamber in accordance to ASTM D1735 for 30 days. Results will be sent via email and mail to client at the end of testing. Up to eight (8) fluids or packaging materials per test.

Estimated time frame of testing*: 42 days

Hydrogen Sulfide & Sulfur Dioxide Chamber Test



Purpose: To determine the rate of corrosion of a test specimen (components coated with fluids, or packaged in material) through accelerated corrosive gas filled environment in a chamber. The rate of corrosion provides an estimated time to first appearance of corrosion caused by the test specimen in a corrosive gas environment.

Description: Testing of a specimen (components coated with fluids, or packaged in material) in the presence of corrosive gases (Hydrogen Sulfide and/or Sulfur Dioxide) in a chamber for up to 30 days. Results will be sent via email and mail to client at the end of testing.

Estimated time frame of testing*: 5 days

**Time starts from the day NTIC receives the sample(s). Test duration is an estimate and depends on when the test sample shows signs of corrosion in the chamber.*

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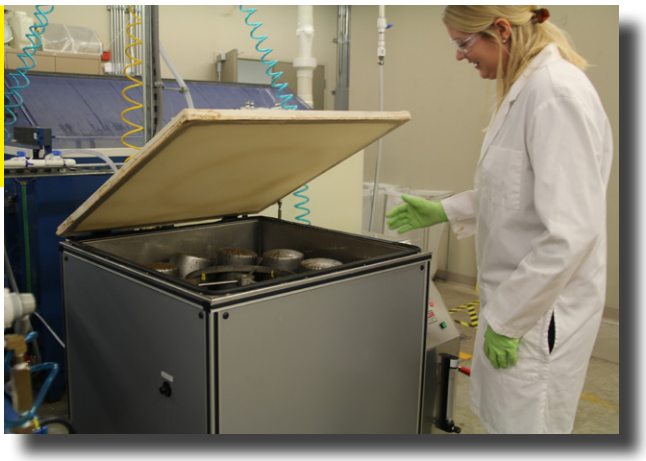
Environmental Chamber (Standard: ASTM D1748)



Purpose: This test chamber is used frequently in the industry to test high humidity with two condensation events per daily cycle. The test is designed for a pass/fail evaluation at a specific time that is determined by the industrial standard the customer is adherent to.

Description: The chamber sometimes called a dishwasher has a reservoir of heated water on the bottom which creates a highly controlled humid environment. The panels are hung on a rotating carrousel above the water. The lid is made from a sail cloth that retains the humid environment and opens automatically twice a day, once for 1 minute and once for 15 minutes. These condensing events cause corrosive stress to the test panels.

Estimated time frame of testing*: 5 days

QUV / Accelerated Weathering (Standard: ASTM G154)

Purpose: The QUV is an environmental testing chamber with UV (ultraviolet) light exposure, condensing humidity and an optional water spray cycle.

Description: The QUV maintains humidity, temperature, and cycles UV exposure to cause tremendous corrosive stress to the panels being tested. There are several standard cycles outlined in ASTM G154.

Estimated time frame of testing*: 5 days

**Time starts from the day NTIC receives the sample(s). Test duration is an estimate and depends on when the test sample shows signs of corrosion in the chamber.*

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Cast Iron Chip Test
(Standard: IP 287/94 & DIN 51360)

Purpose: To do a quick and initial test on the corrosiveness of the manufacturing process fluids that may cause corrosion in export shipments.

Description: Basic test to identify if a processing fluid sample is corrosive. Tested in accordance to IP 287/94 and DIN 51360 standards. Results will be sent via email and mail to the client at the end of testing. One (1) fluid specimen per test.

Estimated time frame of testing*: 5 days

Water Drop Test

Purpose: To determine if the water source used in the various manufacturing processes causes corrosion on metal parts downstream or during export shipments.

Description: A general indicative test to determine the corrosivity of a plant's water source. Results will be sent via email and mail to client at the end of testing. Up to four (4) water specimens per test.

Estimated time frame of testing*: 5 days

**Time starts from the day NTIC receives the sample(s). Test duration is an estimate and depends on when the test sample shows signs of corrosion in the chamber.*

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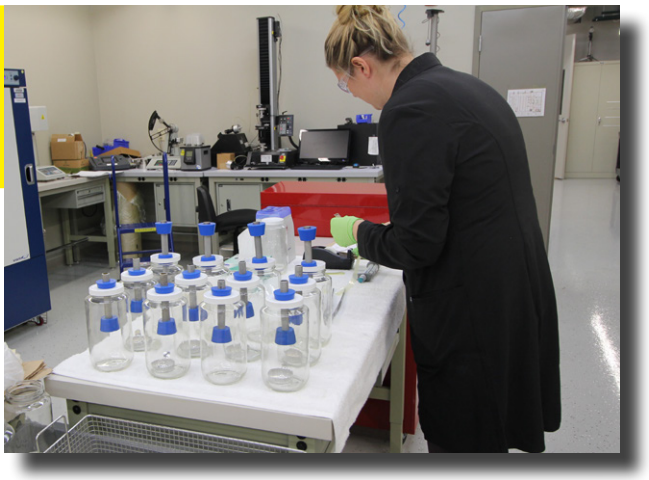
ZERUST® EXCOR® / Performance Testing

VCI Standard Test
(Standard: TM-0208-2015)



Purpose: To determine if a VCI product is providing effective corrosion protection via volatile/vapor corrosion inhibition in accordance to the TM-0208-2015.

Description: TM-0208-2015 - test for the presence of volatile corrosion inhibitor on test specimen in an enclosure without direct contact on test coupon. Results will be sent via email and mail to client at the end of testing. One (1) specimen per test.

Estimated time frame of testing*: 5 days

ZERUST® EXCOR® / Chemical Analysis

Gas-Chromatography Mass-Spectrometry (GC-MS)

Purpose: To determine the identity of volatile organic contaminants in metalworking fluids and on the surfaces of metal parts. Also to determine the extent to which volatile corrosion prevention and mitigation chemistries of fluids have decomposed.

Description: Volatile organic content extracted from liquid and solid samples is characterized via liquid injection, head-space, or SPME GC-MS analysis.

Estimated time frame of testing*: Project-dependent, typically 30 – 60 days

**Time starts from the day NTIC receives the sample(s). Test duration is an estimate and depends on when the test sample shows signs of corrosion in the chamber.*

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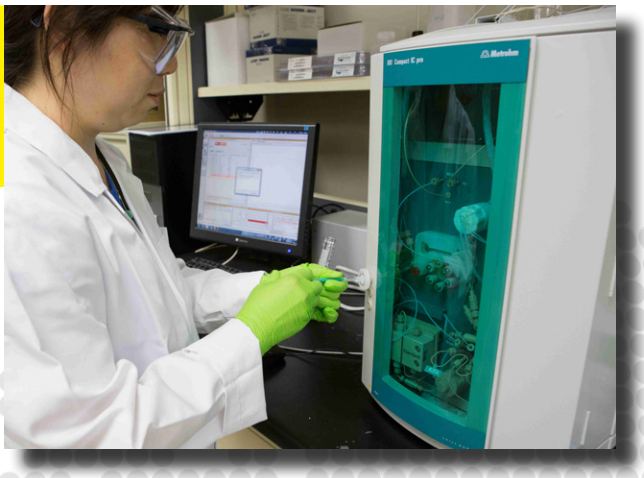
Ion-Chromatography



Purpose: To determine concentration of corrosive ions in the water sources or aqueous fluid samples. Results can indicate the general health of manufacturing fluids, pinpoint specific issues with water sources, or determine other potential causes for concern. Extractions on parts can also be done to determine the type and level of contamination on the surface.

Description: Test to determine the specific type and amount of corrosive ions present in or on a sample. Results will be sent via email and mail to client at the end of testing. One (1) specimen per test.

Estimated time frame of testing*: 5 days

Liquid-Chromatography Mass-Spectrometry (LC-MS)

Purpose: To determine the identity of semi-volatile organic contaminants in metalworking fluids and on the surfaces of metal parts. Also, to determine the extent to which corrosion prevention and mitigation chemistries of fluids have decomposed.

Description: Semi-volatile organic content extracted from liquid and solid samples is characterized via high resolution – accurate mass (HRAM) LC-MS analysis.

Estimated time frame of testing*: Project-dependent, typically 60 – 90 days

**Time starts from the day NTIC receives the sample(s). Test duration is an estimate and depends on when the test sample shows signs of corrosion in the chamber.*

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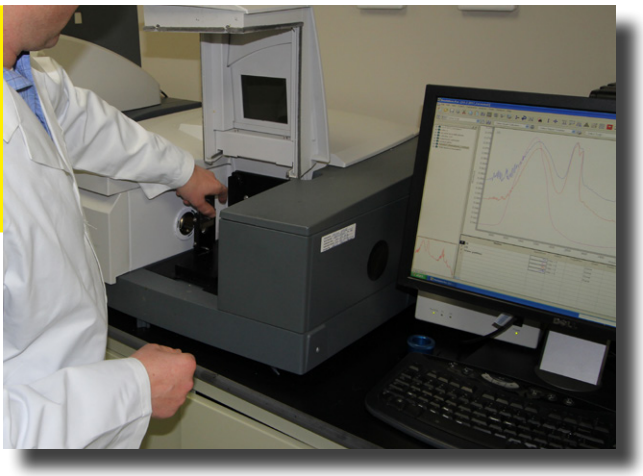
Fourier Transform Infrared Spectroscopy (FTIR) (Standard: ASTM E1252)



Purpose: To aid in the identification of organic contaminants within polymer films, work fluids, and on the surfaces of metal parts.

Description: Polymer film, metalworking fluids, and metal parts are analyzed via transmission or reflectance FTIR in accordance with ASTM E1252.

Estimated time frame of testing*: Project-dependent, typically 0 – 30 days

Bacteria Testing (Fluids)

Purpose: To determine if the water source or used metalworking fluids are contaminated with microbiology. Each fluid sample can be tested for aerobic bacteria, anaerobic bacteria, and fungi. The presence/level of microbiological contamination can be analyzed to determine if microbiologically induced corrosion (MIC) is a potential concern.

Description: Water samples and used aqueous fluids are analyzed using SANI-CHECK BF and SANI-CHECK SRB test kits. Samples are tested, incubated, and analyzed according to SANI-CHECK's recommendations. Results will be sent via email and mail to client at the end of testing. One (1) fluid specimen per test.

Estimated time frame of testing*: 5 days

**Time starts from the day NTIC receives the sample(s). Test duration is an estimate and depends on when the test sample shows signs of corrosion in the chamber.*

Coulometric Karl Fischer (Standard: ASTM D6304)

Purpose: Determine concentration of water in non-aqueous samples. The Coulometric Karl Fischer is used to measure water concentrations in non-aqueous (oil/solvent based) samples when it is known or suspected that the water is less than 1-3%.

Description: The Coulometric Karl Fischer unit uses a special solvent and an electrode to use water molecules as a reagent in an electrolytic reaction with the solvent. The current is measured as the reaction happens to give a very high accuracy for small measures of water in a given sample.

Estimated time frame of testing*: 5-7 days turnaround.

TAN (Standard: ASTM D664) & TBN (Standard: ASTM D4739)

Purpose: Analyze the acid number or base number of oil samples to determine corrosion risk from submitted samples. Can be used to indicate relative health of an oil if comparing new and used samples.

Description: General indicative test to determine acidity or basicity of an oil sample – much like testing the pH of an aqueous sample. Results will be sent via email and mail to client at the end of testing. One (1) oil specimen per test.

Estimated time frame of testing*: 5 days

**Time starts from the day NTIC receives the sample(s). Test duration is an estimate and depends on when the test sample shows signs of corrosion in the chamber.*

Mechanical Property Test (Standard: ASTM D882, D1709, D1922, D1938)

Purpose: To determine the mechanical properties of polymeric materials (tensile, compression, bend, peel, tear, and other mechanical tests) on materials and products to ASTM, ISO, and other industry standards.

Description: Testing of polymeric material/specimen for the physical properties (ASTM D882 for tensile property, ASTM D1709 for dart impact, and ASTM D1922 & D1938 for tear resistance). Results will be sent via email and mail to client at the end of testing. One (1) specimen per test.

Estimated time frame of testing*: 7 days

Thermal Gravimetric Analysis (TGA)

Purpose: A method of thermal analysis in which the mass of a sample is measured over time as the temperature changes. Common usage includes investigation, selection, comparison and end-use performance evaluation of materials in research, quality control and production applications.

Description: This Instrument provides information about physical phenomena, such as phase transitions, absorption and desorption; as well as chemical phenomena including chemisorptions, thermal decomposition, and oxidation or reduction.

Estimated time frame of testing*: 5 days

**Time starts from the day NTIC receives the sample(s). Test duration is an estimate and depends on when the test sample shows signs of corrosion in the chamber.*

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Differential Scanning Calorimetry (DSC)

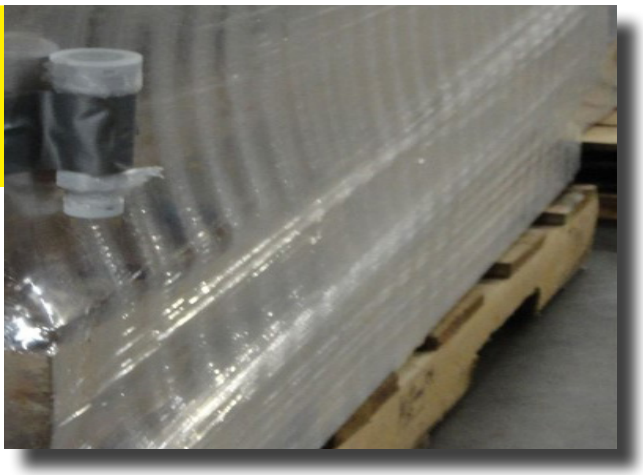
Purpose: To measure temperatures and heat flows associated with thermal transitions in a material. Common usage includes investigation, selection, comparison and end-use performance evaluation of materials in research, quality control and production applications.

Description: Testing samples to identify glass transitions, “cold” crystallization, phase changes, melting, crystallization, product stability, cure / cure kinetics, and oxidative stability of polymeric and crystalline components.

Estimated time frame of testing*: 5 days

**Time starts from the day NTIC receives the sample(s). Test duration is an estimate and depends on when the test sample shows signs of corrosion in the chamber.*

Data Logger Analysis



Purpose: To provide the service to extract and analyze data from data loggers used in monitoring temperature and relative humidity during test shipments. The analysis may reveal possible periods of atmospheric conditions accelerating corrosion during the shipment.

Description: Extraction of data recorded on data logger, plotting of RH and predictions of dew point temperature charts, analysis recommendations, and documentation. Results will be sent via email and mail to client at the end of analysis.

Estimated time frame of testing*: 5 days

**Time starts from the day NTIC receives the sample(s). Test duration is an estimate and depends on when the test sample shows signs of corrosion in the chamber.*

Basic Corrosion Prevention Training

Purpose: To provide basic corrosion training and use of ZERUST®/EXCOR® products to operators and engineers so that simple causes of corrosion failures can be prevented.

Description: On site training session on the appropriate handling methods, precautions, ZERUST®/EXCOR® products, and basic corrosion knowledge. Training material, speaker's notes, and documentation (packaging guidelines, etc.) will be provided by ZERUST®/EXCOR® personnel. This session is designed for a class size of 5 to 15 participants. No prior knowledge of corrosion protection is necessary. Fees are quoted per session and do not include travel expenses. ZERUST®/EXCOR® personnel will obtain permission from Client on reimbursement of travel expenses before engaging in the job.

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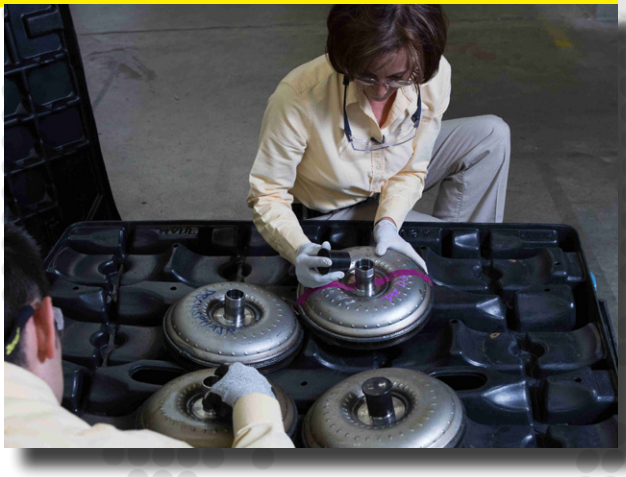
Z-CIS® Problem Solving, On Site Visits, On Site Manufacturing Process Mapping, Shipment Inspection, Part and Fluid Sampling, Formal Report Writing.



Purpose: To provide problem solving service on corrosion problems with component shipments or shipment inspection site visit services.

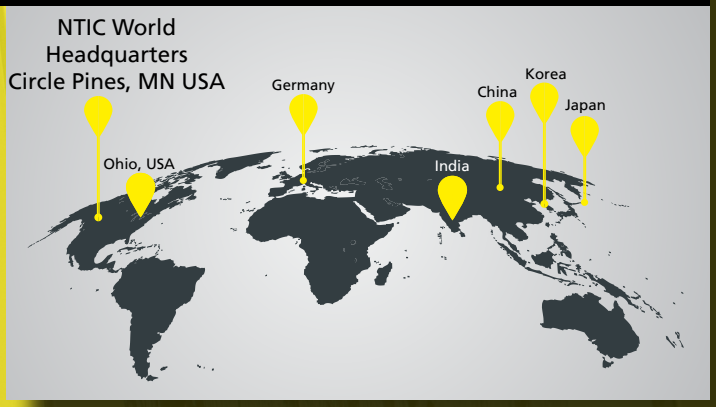
Description: On site visit to inspect, install/retrieve data loggers, investigate, map out and identify problems and/or potential areas of corrosion causing factors in the manufacturing process. Typical process map requires 4 hours on site visit depending on the complexity of the manufacturing process and corrosion problem. Client must allow ZERUST®/EXCOR® personnel to take photos, collect MSDS data, copy relevant sections of the PFMEA (Process Failure Mode & Effect Analysis) and control plans. Reports will be sent via email and mail to client at the end of analysis. Fees are charged per hour and do not include travel expenses. ZERUST®/EXCOR® personnel will obtain permission from Client on reimbursement of travel expenses before engaging in the job.

We Offer Worldwide Technical Support

Our internationally recognized scientists and field engineers work closely with customers to design and implement comprehensive corrosion management systems. Then, ZERUST®/EXCOR® representatives located across the globe provide onsite technical support to ensure the efficacy of these solutions. Our application engineers will assist with the on site preparation and packaging of test shipments. At its destination, the shipment may be inspected and evaluated by a global ZERUST®/EXCOR® representative.

Lab and Test Facilities Across the Globe

The effectiveness of the proposed corrosion management system can be evaluated under simulated extreme climatic conditions in one of our multiple worldwide regional ZERUST®/EXCOR® technical support centers.



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