

**CREDENTIALS**

40+ years of experience in corrosion prevention.

Client support in 50+ countries.

Chair key task group at NACE International.

**MEMBERSHIPS**



Zerust Flange Saver®  
 Zerust ReCAST-R™  
 2012: Winner of the MP Readers' Choice NACE Corrosion Innovation of the Year award

# Zerust® Tank SSB IDS Solutions

SOIL SIDE BOTTOM CORROSION MANAGEMENT FOR ABOVEGROUND STORAGE TANKS



## The Problem

Soil Side Bottom (SSB) corrosion of Aboveground Storage Tanks (ASTs) is a major cause of tank bottom failures. Such failures are often time consuming and expensive to repair and may pose as a potential hazard to the surrounding environment. The corrosion of tank bottom plates is often propagated by the ingress of external contaminants and moisture through gaps existing between the metallic plates and the underlying tank foundation. Other factors influencing the propagation of corrosion to tank bottom plates include: destruction of coating on the plates from welding or repairs, degradation of the underlying foundation over time, and porous foundation types that, in nature, contain pre-existing gaps or void spaces, such as concrete or double-bottom designs.

Traditional Cathodic Protection (CP) methods are often utilized to prevent SSB corrosion, but these methods present with their own restrictions and limitations. Such limitations include the resistivity of the underlying foundation, disruptions to the imposed current (either from environmental factors or tank construction), existing gap or void spaces, etc. The restrictions of traditional CP systems necessitate the option for additional means of corrosion protection.

## TANK BOTTOM PLATE CORROSION LEADS TO COSTLY REPAIRS AND LOST REVENUE!

Maintenance Costs
Purging and/or Cleaning
Replacement of Bottom Plates
Installation of Release Prevention Barrier (RPB) or Liner
Additional Inspections

Operation Costs
Downtime for Repairs or Replacements
Environmental Concerns
Revenue Loss

## The Solution

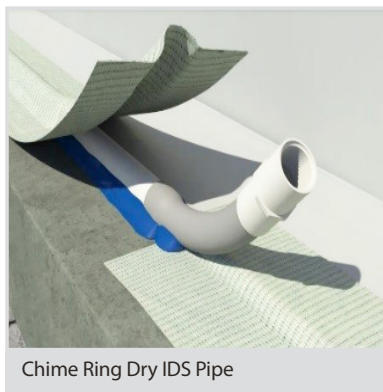
Zerust Vapor Corrosion Inhibitors (VCIs) Are A Cost-Effective Way to Control Corrosion

Zerust Oil & Gas Tank SSB Inhibitor Delivery System (IDS) solutions provide a cost-effective means to mitigate underside corrosion of aboveground storage tanks while the tanks are in or out of service. Whether tank single or double bottoms rest on compacted sand, concrete, soil or bitumen, Zerust Oil & Gas has a solution to extend the serviceable life of these assets. Listed below are Zerust's methods of introducing a VCI to the tank bottom environment, based on the design of the foundation and whether the tank is in service or out of service.



## Chime Ring Dry

The Zerust patented Chime Ring Dry IDS solution is recommended for storage tanks with concrete or bitumen foundations. Zerust Oil & Gas has designed an innovative VCI/SCI (Soluble Corrosion Inhibitor) injection system to protect the tank bottom from corrosion. Perforated PVC pipe is installed around the entire annular chime area. The VCI dry sleeves are installed into the PVC pipe and the system is sealed to create an enclosure to maintain the VCIs. The VCIs migrate and absorb onto the metal surface. The diffusion of VCIs provides corrosion protection in the critical 3 to 4 meters from the annular chime ring.



Chime Ring Dry IDS Pipe

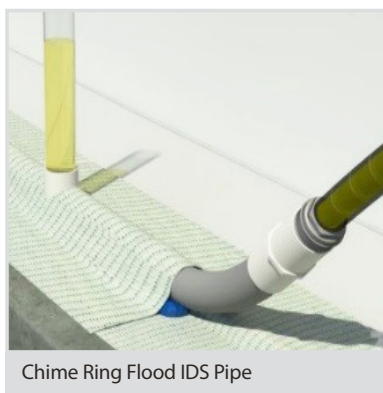


VCI Dispersion from Mesh Sleeve

**FOUNDATION(S): CONCRETE, BITUMEN, COMPACTED SAND OR SOIL.**

## Chime Ring Flood

Zerust's patented Chime Ring Flood IDS solution is suitable for storage tanks with concrete, bitumen, or sand with liner foundations. Zerust Oil & Gas has designed an innovative VCI/SCI (Soluble Corrosion Inhibitor) injection system to protect the tank bottom from corrosion. The Chime Ring Flood IDS system features the same delivery installation as the Chime Ring Dry IDS solution. As the inhibitor slurry is pumped into the perforated PVC chime ring system, the VCIs migrate and absorb onto the metal surface. Meanwhile, the liquid inhibitor slurry works to neutralize any contaminants it may contact on either the bottom plates or foundation. The combination of VCIs and SCIs work together to protect vulnerable areas of the tank bottom plates from corrosion.



Chime Ring Flood IDS Pipe



VCI Dispersion from Slurry

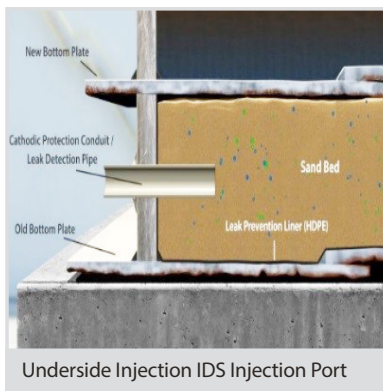
**FOUNDATION(S): CONCRETE, BITUMEN, COMPACTED SAND OR SOIL (ALL FOUNDATIONS MUST INCLUDE A LINER OR RPB).**

## Underside Injection

Zerust's Underside Injection IDS solution is designed for tanks with compacted sand fill and Release Prevention Barriers (RPBs), Double Bottoms with sand between the old and new floors, or tanks sitting on a hard pad such as concrete or asphalt.

The tank chime is sealed to prevent the ingress of moisture and contaminants. Low-viscosity inhibitor slurry is pumped through designated ring wall ports into the sand bed. As the slurry flows throughout the entire sand bed, the SCIs effectively neutralize contaminants on contact. Conversely, the VCIs emitted by the slurry migrate and absorb onto the metal surface.

The VCIs permeate the sand bed through capillary action and gravity, providing protection to the entire tank floor.



Underside Injection IDS Injection Port



VCI Dispersion from Slurry

**FOUNDATION(S): COMPACTED SAND OR SOIL (WITH LINER OR RPB); DOUBLE BOTTOM DESIGNS WITH COMPACTED SAND OR SOIL; HARDPADS.**

## Internal Flood

The Internal Flood IDS solution is suitable for tank foundations of concrete, bitumen, or compacted sand with liners. Low-viscosity inhibitor slurry is pumped into one or more temporary injection ports installed in selected locations through the tank floor. The VCIs emitted by the slurry migrate and absorb onto the metal surface. The SCIs work to neutralize any contaminants it may contact on either the bottom plates or foundation. The multiple injection points allow for quick dispersion of the slurry across the entire tank bottom.



Internal Flood IDS Injection Port

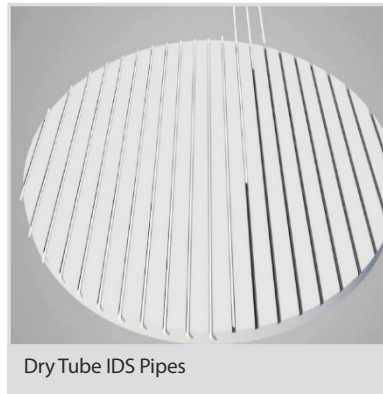


VCI Dispersion from Slurry

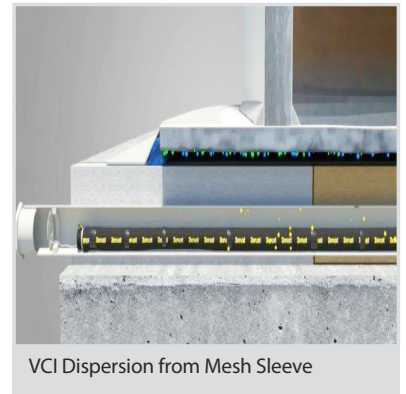
**FOUNDATION(S): CONCRETE, BITUMEN, COMPACTED SAND OR SOIL (ALL FOUNDATIONS MUST INCLUDE A LINER OR RPB).**

## Dry Tube

The Dry Tube IDS system is designed to protect tank bottom plates during construction or new floor installation. This solution benefits tanks with concrete, bitumen, and compacted sand foundations with or without liners. Shallow trenches are cut into the foundation. Perforated, mesh-covered PVC pipes are placed within the trenches and the trenches are then filled with sand. The tank chime is sealed to prevent the ingress of moisture and contaminants, and dry mesh sleeves of VCI inhibitor are installed into each of the pipe tubes. The system is sealed to allow an enclosed area for the VCIs to rise from the sand in the tube channels, and the VCIs work to mitigate corrosion on the metal bottom plates of the tank.



Dry Tube IDS Pipes

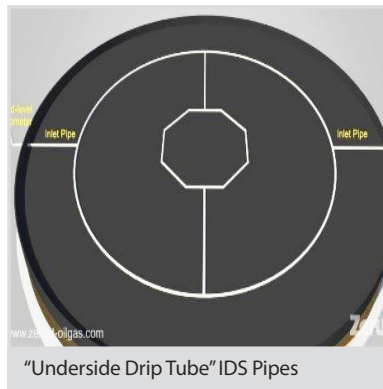


VCI Dispersion from Mesh Sleeve

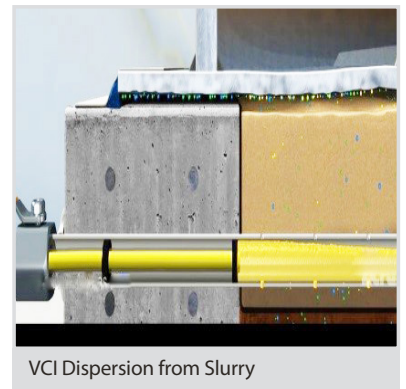
**FOUNDATION(S): CONCRETE, BITUMEN, COMPACTED SAND OR SOIL.**

## Underside Drip Tube

The Underside Drip Tube IDS is an innovative solution that protects tank bottom plates of single or double bottom tanks during construction or new floor installation. A network of perforated PVC pipes with mesh sleeves are installed in rings on top of the tank liner in the sand foundation. Inlet pipes penetrate the ring wall, allowing access points to the PVC pipe system. The tank chime is sealed, preventing the ingress of moisture and contaminants from entering the system. Low-viscosity inhibitor slurry is pumped into the designated ring wall port(s) into the sand bed, and the perforated PVC pipe network distributes the slurry evenly throughout the system. The VCIs are released from the sand bed, protecting the metal bottom plates of the tank. Conversely, the SCIs in the inhibitor neutralize contaminants in the sand bed. The injection port(s) can be used for future inhibitor injections.



"Underside Drip Tube" IDS Pipes



VCI Dispersion from Slurry

**FOUNDATION(S): CONCRETE, BITUMEN, COMPACTED SAND OR SOIL (ALL FOUNDATIONS MUST INCLUDE A LINER OR RPB).**

## Tank SSB IDS Benefits

Provide the option for replenishment.

Can be combined with simple monitoring procedures to ensure effectiveness of the solution.

Corrosion protection for voids and interstices that are impossible to protect with other methods.

Protection for tank bottom plates and welds with little to no surface preparation.

VCI offers non-permanent corrosion protection at the molecular level that is safe and eco-friendly.

Zerust methods of VCI dispersion ensures uniform distribution.

Service life of tank bottom can be increased significantly at minimal cost.

## Solution Effectiveness

Zerust IDS solutions are comprehensive and proven methods for protecting storage tanks with soil side bottoms.

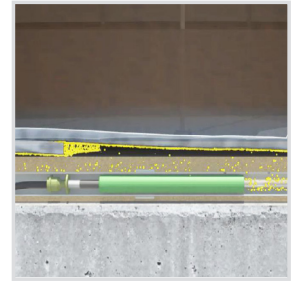
Zerust IDS solutions reduce overall costs to tank farm owners while increasing corrosion prevention efficacy.

Tank operations do NOT need to be stopped during inspection or maintenance of the SSB solutions.

## Electrical Resistance (ER) Probes

Electrical resistance (ER) probes are inserted into the sand or soil foundation to measure the corrosivity of the underlying environment. Baseline corrosion rates are determined by monitoring the change in resistance over time detected by the ER probes. The vapors emitted from the VCI slurry protect the ER probes, demonstrating the effectiveness of the VCI.

ER probe tubes are installed in various points to provide estimates of bottom plate corrosion. The ER probe cables are stored outside the ring wall to provide corrosion readings while the tank is in service.



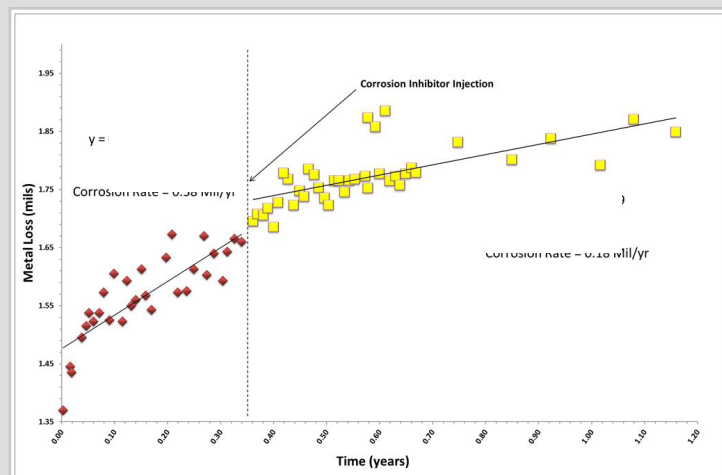
## Zerust solutions for tank bottom protection

### CASE STUDY: SSB INSTALLATION

The efficacy of Zerust Oil & Gas' Underside Injection IDS solution was demonstrated at a recent installation. The IDS solution needed to be implemented without stopping tank operations, and the Underside Injection system was determined to be the most appropriate solution to suit the client's needs. With this delivery system, liquid inhibitor slurry is introduced into the sand bed base under the tank through injection ports. The slurry spreads across the lined bottom of the sand bed, and the VCI will volatilize from the slurry to reach the entire soil side bottom of the tank.

The effectiveness of the Underside Injection IDS solution was determined by taking metal loss readings before and after injection using ER probes and a datalogger. The metal loss readings were converted into corrosion rates for the time periods before and after corrosion inhibitor injection. A plot of average ER Probe data from a field installation is shown below. Data from this installation shows a three fold reduction of the baseline corrosion rate.

Metal Loss Versus Time



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