DAUBERT CROMWELL

The Leading Name in Corrosion Prevention®

Guide to Preventing Corrosion in Lay-Up, Preservation and Mothballing

Version 1.0

Introduction

This Guide to Preventing Corrosion in Lay-Up, Preservation and Mothballing is a resource for deciding the product and method for preventing corrosion on equipment. Each preservation project requires consideration of various factors, including the intended term of protection, the storage conditions, the available resources for installation and the value of the equipment Use this guideline as a starting point for assessing and understanding product and installation options. More specific support may be available for field assessments and installation under Daubert Cromwell's "Installed Services" program. Please consult your Daubert Cromwell Sales Representative prior to starting any of these programs.

This resource provides guidance for mothballing typical plant equipment. It is organized into four parts;

1) A Preservation Plan
2) Processing Plant Equipment
3) Product Reference Charts
4) Project Examples.

Making and following a plan is critical to being able to measure the project's success. Success will be measured as having adequate protection to prevent corrosion at the lowest cost.

Adequate protection relates to no corrosion on critical surfaces and as defined by the client. Sometimes cosmetic rust is acceptable if the cost of preservation is greater than the depreciation, rework or replacement costs of the part.

Cost should be compared over the term of the mothballing period. Cost of no preservation or poor protection includes replacement of equipment, parts, labor and downtime. Cost of preservation includes preservation products plus the labor to install and remove them. Of all the costs, the ones least likely to impact the project costs are the preservation products. However, the selection of those products and their proper installation has the greatest impact on other costs.

As an example, the costs for a gallon of liquid preservative verses wrapping the equipment with VCI might show the VCI bags covering the same area as the liquid to be more expensive. When all costs, including the labor to dip or spray and later remove the coating with solvents or steam cleaning, and the associated waste and handling of the bi-products, then the scale may tip towards the VCI option. On the other hand, lower value parts or ones not practical to wrap may lean the balance towards applying a heavy coating of a long term liquid protector.

This guideline is intended to help you understand the associated costs and to help you make the comparisons that meet your project needs. You will likely realize that not all items will require the same treatment. Let's get started.

Contents

Step 1: Define the Term of Protection.

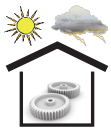
"Mothballing" typically refers to idle periods greater than 6 months, when equipment must be kept in a ready-to-use state without regular maintenance. During this time, seasonal temperature changes may affect the ambient temperature fluctuations.

Shorter periods of plant shutdowns are considered extended shutdowns. During extended shutdowns, power, heat, water and other services may remain available. Manpower is also available to conduct preventive maintenance, reapply preservatives and monitor the corrosion occurrence.

This guide groups Term of Protection as 1-18 months, 18-60 months and +60 months. The 1-18 month protection plan is intended to maintain a plant or unit in a state of preservation that is both relatively easy to apply and remove. This is also applicable to extended shutdowns. The 18-60 month program considers that fewer personnel will be available to monitor the protection. Depending on the environment, greater amounts of protection may be recommended. The +60 month program will include additional record keeping of inspections and maintenance records.

Step 2: Consider the Type of Storage and Conditions:

Three types of storage and conditions:

	**Indoor Storage** - Parts are both covered and there is limited access to outside air.
	**Outdoor Covered** - An open shed or lean-to, where the parts are covered from sun and rain but temperature and humidity fluctuations are similar to outdoors. This category can also include parts stored in outdoor containers that are in reasonable condition.
	**Outdoor Uncovered** - Yard storage where the parts are exposed to sun, rain and the open air.

Step 3: Understand the concepts of preservation.

One of the key objectives for preservation of equipment is to reduce the amount of corrosion during the time it is not in use. In climates that are in excess of 50% RH, mildew and mold containment issues need to be addressed. For example, if equipment or parts are put into plain plastic, the chances for reaching these levels increase (green house effect). Considering these events in advance will help to reduce losses incurred from corrosion and or mildew.

Corrosion (rusting) naturally occurs on metals. On steel it is the cyclical process when iron takes on oxide to become iron oxide (aka Iron Ore). Stopping or slowing down the corrosion process requires a stable oxide layer needed to passivate this process. Corrosion inhibitors may be contained in paints, oils and greases. These are typically Contact Inhibitors that need to be applied to the metal's surface. Another type of protection are Volatile Corrosion Inhibitors (VCI). As the name implies, the added feature of volatility takes advantage of its adsorption (not absorption) property and giving it its affinity to the metal as if it was a polar attraction. Once the VCI has transferred from the carrier to the metal, its light polar bond is temporary and needs to be in a confined and protected space. This is why the VCIs are most often used in a packaging environment or in a contained cavity not exposed to open air movement and water flow. Typical carriers of VCI include papers, poly films, devices such as foam or emitters, and liquids including both water- and petroleum-based. For more detail on these concepts please ask for our technical series presentations; "How Daubert Cromwell VCIs Work" and "Daubert Cromwell VCI Packaging Designs".

Part 2 - Processing Plant Equipment

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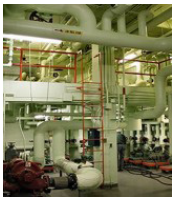
Water Lines (Non-Potable)			
	1-18 Month Protection Program	**18-60 Month Protection Program**	**+60 Month Protection Program**
	• Drain water lines completely. As an option to blowing dry and purging with nitrogen oxide and drilling holes at low points, add Nox-Rust 1200 to the water rinse. The Nox-Rust 1200 will deposit VCI to the surfaces. See recommendations on usage rates.	• Drain water lines completely. As an option to blowing dry and purging with nitrogen oxide and drilling holes at low points, add Nox-Rust 1200 to the water rinse. The Nox-Rust 1200 will deposit VCI to the surfaces. See recommendations on usage rates • Spray exterior surfaces of valves with Safecote A • Remove valves on lines >24" dia and coat internals with Safecote A, add Nox-Rust 3100 to bonnets of gate valves • Coat exposed valve stems with Nox-Rust 3100 • Coat all bolts and nuts with Safecote A	• Drain water lines completely. As an option to blowing dry and purging with nitrogen oxide and drilling holes at low points, add Nox-Rust 1200 to the water rinse. The Nox-Rust 1200 will deposit VCI to the surfaces. See recommendations on usage rates • Spray exterior surfaces of valves with Safecote A • Remove valves on lines >24" dia and coat internals with Safecote A, add Nox-Rust 3100 to bonnets of gate valves • Coat exposed valve stems with Nox-Rust 3100 • Coat all bolts and nuts with Safecote A

Piping, Valves and Fittings			
	1-18 Month Protection Program	**18-60 Month Protection Program**	**+60 Month Protection Program**
Stainless Steel and Non-Ferrous Alloys	• Drain water lines completely and as an option to blowing dry and purging with nitrogen oxide and drilling holes at low points, add Nox-Rust 1200 to the water rinse. The Nox-Rust 1200 will deposit VCI to the surfaces. See recommendations on usage rates.	• Drain water lines completely and as an option to blowing dry and purging with nitrogen oxide and drilling holes at low points, add Nox-Rust 1200 to the water rinse. The Nox-Rust 1200 will deposit VCI to the surfaces. See recommendations on usage rates. • Cover exposed valve stems with Nox-Rust 3100 grease • Coat exposed threads of drain and vent valves with Safecote A	• Drain water lines completely and as an option to blowing dry and purging with nitrogen oxide and drilling holes at low points, add Nox-Rust 1200 to the water rinse. The Nox-Rust 1200 will deposit VCI to the surfaces. See recommendations on usage rates • Cover exposed valve stems with Nox-Rust 3100 grease • Coat exposed threads of drain and vent valves with Safecote A • Cover gaps between flanges with Premium Metal-Guard Stretch Wrap
Carbon and Low Alloy Steel 	• Drain water lines completely and as an option to blowing dry and purging with nitrogen oxide and drilling holes at low points, add Nox-Rust 1200 to the water rinse. The Nox-Rust 1200 will deposit VCI to the surfaces. See recommendations on usage rates. • Cover exposed valve stems with Nox-Rust 3100 grease • Consider removing valves >12" dia spray inside with Nox-Rust 7800 and reinstall for 12+ month shutdown • Spray Nox-Rust 7800 between flanges of critical lines (marine applications spray all flanges) • Coat exposed threads of small drain and vent valves with Nox-Rust 7800 or Safecote A	• Drain water lines completely and as an option to blowing dry and purging with nitrogen oxide and drilling holes at low points, add Nox-Rust 1200 to the water rinse. The Nox-Rust 1200 will deposit VCI to the surfaces. See recommendations on usage rates. • Cover exposed valve stems with Nox-Rust 3100 • Remove valves >12" dia spray inside with Nox-Rust Safecote A and reinstall • Clean and coat flange surfaces out to the edges with Safecote A or Premium Metal-Guard Stretch and Versil-Pak • Coat exposed threads of small drain and vent valves with Safecote A • Coat small drain and vent valves with Safecote A • Coat hangars and pipe line support with Safecote A • Add Nox-Rust 1100 to the oils in the bonnets	• Drain water lines completely and as an option to blowing dry and purging with nitrogen oxide and drilling holes at low points, add Nox-Rust 1200 to the water rinse. The Nox-Rust 1200 will deposit VCI to the surfaces. See recommendations on usage rates. • Cover exposed valve stems with Nox-Rust 3100 • Remove valves >12" dia spray inside with Safecote A and reinstall • Clean and coat flange surfaces out to the edges with Safecote A or Premium Metal-Guard Stretch and Versil-Pak • Coat exposed threads of small drain and vent valves with Safecote A • Coat small drain and vent valves with Safecote A • Coat hangars and pipe line support with Safecote A • Add Nox-Rust 1100
Lined Low Allow Steel	• Drain water lines completely and as an option to blowing dry and purging with nitrogen oxide and drilling holes at low points, add Nox-Rust 1200 to the water rinse. The Nox-Rust 1200 will deposit VCI to the surfaces. See recommendations on usage rates. • Cover exposed valve stems with Nox-Rust 3100 • Spray Nox-Rust 7800 (provided is compatible with pipe lining) between flanges (marine applications spray all flanges). • Coat exposed threads of small drain and vent valves with Nox-Rust 5200 or Safecote A for >12 months)	• Drain water lines completely and as an option to blowing dry and purging with nitrogen oxide and drilling holes at low points, add Nox-Rust 1200 to the water rinse. The Nox-Rust 1200 will deposit VCI to the surfaces. See recommendations on usage rates. • Cover exposed valve stems with Safecote A or Nox-Rust 3100 • Spray Safecote A (provided is compatible with pipe lining) between flanges (marine applications spray all flanges). • Coat exposed threads of small drain and vent valves with Nox-Rust Safecote A	• Drain water lines completely and as an option to blowing dry and purging with nitrogen oxide and drilling holes at low points, add Nox-Rust 1200 to the water rinse. The Nox-Rust 1200 will deposit VCI to the surfaces. See recommendations on usage rates. • Cover exposed valve stems with Safecote A or Nox-Rust 3100 • Spray Safecote A (provided is compatible with pipe lining) between flanges (marine applications spray all flanges). • Coat exposed threads of small drain and vent valves with Safecote A • Cover gaps between flanges with Premium Metal-Guard Stretch Wrap • Coat small drain and vent valves with Safecote A or Nox-Rust 3100 • Coat pipe hangars and supports with Safecote A • Coat all exposed surfaces with Safecote A

Flare Systems			
	1-18 Month Protection Program	18-60 Month Protection Program	+60 Month Protection Program
	• Drain water lines completely and as an option to blowing dry and purging with nitrogen oxide and drilling holes at low points, add Nox-Rust 1200 to the water rinse. The Nox-Rust 1200 will deposit VCI to the surfaces. See recommendations on usage rates.	• Drain water lines completely and as an option to blowing dry and purging with nitrogen oxide and drilling holes at low points, add Nox-Rust 1200 to the water rinse. The Nox-Rust 1200 will deposit VCI to the surfaces. See recommendations on usage rates. • Clean and coat all flange faces out to the edges with Nox-Rust Safecote A and reassemble	• Drain water lines completely and as an option to blowing dry and purging with nitrogen oxide and drilling holes at low points, add Nox-Rust 1200 to the water rinse. The Nox-Rust 1200 will deposit VCI to the surfaces. See recommendations on usage rates. • Clean and coat all flange faces out to the edges with Premium Metal-Guard Stretch Wrap and Versil-Pak and fill gap with tape

Process Vessels and Tanks			
	1-18 Month Protection Program	18-60 Month Protection Program	+60 Month Protection Program
Stainless and NF Alloys	• Drain water lines completely and as an option to blowing dry and purging with nitrogen oxide and drilling holes at low points, add Nox-Rust 1200 to the water rinse. The Nox-Rust 1200 will deposit VCI to the surfaces. See recommendations on usage rates. • If marine or heavy industrial location, coat all joints, crevices, etc. with Nox-Rust 5200 or Safecote A to prevent egress of airborne contaminants	• Drain water lines completely and as an option to blowing dry and purging with nitrogen oxide and drilling holes at low points, add Nox-Rust 1200 to the water rinse. The Nox-Rust 1200 will deposit VCI to the surfaces. See recommendations on usage rates. • If marine or heavy industrial location, coat all joints, crevices, etc. with Safecote A and cover with Premium Metal-Guard and Versil-Pak (outdoor locations)	• Drain water lines completely and as an option to blowing dry and purging with nitrogen oxide and drilling holes at low points, add Nox-Rust 1200 to the water rinse. The Nox-Rust 1200 will deposit VCI to the surfaces. See recommendations on usage rates. • If marine or heavy industrial location, coat all joints, crevices, etc. with Safecote A and cover with Premium Metal-Guard and Versil-Pak (outdoor locations)
Carbon Steel	• Drain water lines completely and as an option to blowing dry and purging with nitrogen oxide and drilling holes at low points, add Nox-Rust 1200 to the water rinse. The Nox-Rust 1200 will deposit VCI to the surfaces. See recommendations on usage rates. • Coat bolting with Safecote A • Coat open flange faces with Nox-Rust 5200 or Safecote A after cleaning • Cover open flanges, pipe ends and other openings with Versil-Pak or Premium Metal-Guard and cover with blank when possible • For more critical applications, insert Daubrite Emitters (D1, D5 or D10) and seal all openings	• Drain water lines completely and as an option to blowing dry and purging with nitrogen oxide and drilling holes at low points, add Nox-Rust 1200 to the water rinse. The Nox-Rust 1200 will deposit VCI to the surfaces. See recommendations on usage rates. • Coat bolting with Safecote A • Coat open flange faces with Safecote A after cleaning and cover gaps between flanges with Premium Metal-Guard and Versil-Pak (outdoor locations) • Cover open flanges, pipe ends and other openings with Versil-Pak or Premium Metal-Guard and cover with blank when possible • For more critical applications, insert Daubrite Emitters (D1, D5 or D10) and seal all openings	• Drain water lines completely and as an option to blowing dry and purging with nitrogen oxide and drilling holes at low points, add Nox-Rust 1200 to the water rinse. The Nox-Rust 1200 will deposit VCI to the surfaces. See recommendations on usage rates. • Coat bolting with Safecote A • Coat open flange faces with Safecote A after cleaning and cover gaps between flanges with Premium Metal-Guard and Versil-Pak (outdoor locations) • Cover open flanges, pipe ends and other openings with Versil-Pak or Premium Metal-Guard and cover with blank when possible • Coat anchor bolts with Nox-Rust 3100 • For more critical applications, insert Daubrite Emitters (D1, D5 or D10) and seal all openings
Reactors	• Add Nox-Rust 1200 to water-based (and Nox-Rust 1100 to oil-based) internals of jackets	• Add Nox-Rust 1200 to water-based (and Nox-Rust 1100 to oil-based) internals of jackets • Coat open flange faces with Safecote A after cleaning and cover gaps between flanges with Premium Metal-Guard and Versil-Pak (outdoor locations)	• Add Nox-Rust 1200 to water-based (and Nox-Rust 1100 to oil-based) internals of jackets • Coat open flange faces with Safecote A after cleaning and cover gaps between flanges with Premium Metal-Guard and Versil-Pak (outdoor locations)
Towers, Spheres, Bullets	• Drain water lines completely and as an option to blowing dry and purging with nitrogen oxide and drilling holes at low points, add Nox-Rust 1200 to the water rinse. The Nox-Rust 1200 will deposit VCI to the surfaces. See recommendations on usage rates. • Insert Daubrite Emitters (D1, D5 or D10) and seal all openings • Coat areas between flanges with Nox-Rust 7800 or Safecote A (seal gaps with Premium Metal-Guard and Versil-Pak in marine or heavy industrial environments).	• Drain water lines completely and as an option to blowing dry and purging with nitrogen oxide and drilling holes at low points, add Nox-Rust 1200 to the water rinse. The Nox-Rust 1200 will deposit VCI to the surfaces. See recommendations on usage rates. • Insert Daubrite Emitters (D1, D5 or D10) and seal all openings • Coat areas between flanges with Nox-Rust 7800 or Safecote A (seal gaps with Premium Metal-Guard and Versil-Pak in marine or heavy industrial environments). • Coat bolting with Safecote A • Coat anchor bolts with Nox-Rust 3100	• Drain water lines completely and as an option to blowing dry and purging with nitrogen oxide and drilling holes at low points, add Nox-Rust 1200 to the water rinse. The Nox-Rust 1200 will deposit VCI to the surfaces. See recommendations on usage rates. • Insert Daubrite Emitters (D1, D5 or D10) and seal all openings • Coat areas between flanges with Nox-Rust X-285 (7800) or Safecote A (seal gaps with Premium Metal-Guard and Versil-Pak in marine or heavy industrial environments). • Coat bolting with Safecote A • Coat anchor bolts with Nox-Rust 3100)

Coolers and Exchangers

	1-18 Month Protection Program	18-60 Month Protection Program	+60 Month Protection Program
Cooling Towers	• Drain water lines completely and as an option to blowing dry and purging with nitrogen oxide and drilling holes at low points, add Nox-Rust 1200 to the water rinse. The Nox-Rust 1200 will deposit VCI to the surfaces. See recommendations on usage rates. • Grease and / or oil fans, gearboxes, etc. with Nox-Rust 3100 or Nox-Rust 7800 as applicable	• Drain water lines completely and as an option to blowing dry and purging with nitrogen oxide and drilling holes at low points, add Nox-Rust 1200 to the water rinse. The Nox-Rust 1200 will deposit VCI to the surfaces. See recommendations on usage rates. • Grease and / or oil fans, gearboxes, etc. with Nox-Rust 3100 or Nox-Rust 7800 as applicable • Drain the oil from gear reducer housing and refill it with Nox-Rust 7800 • Coat with Safecote A exposed portions of shafts and wraps with Premium Metal-Guard or PC55D • Coat fan gears with Nox-Rust 3100 and wrap with Premium Metal-Guard or PC55D	• Drain water lines completely and as an option to blowing dry and purging with nitrogen oxide and drilling holes at low points, add Nox-Rust 1200 to the water rinse. The Nox-Rust 1200 will deposit VCI to the surfaces. See recommendations on usage rates. • Grease and / or oil fans, gearboxes, etc. with Nox-Rust 3100 or Nox-Rust 7800 as applicable • Drain the oil from gear reducer housing and refill it with Nox-Rust 7800 • Coat with Safecote A exposed portions of shafts and wraps with Premium Metal-Guard or PC55D • Coat fan gears with Nox-Rust 6100 and wrap with Premium Metal-Guard or PC55D
Spray Coolers	• Drain water lines completely and as an option to blowing dry and purging with nitrogen oxide and drilling holes at low points, add Nox-Rust 1200 to the water rinse. The Nox-Rust 1200 will deposit VCI to the surfaces. See recommendations on usage rates. Blank the inlet and product line	• Drain water lines completely and as an option to blowing dry and purging with nitrogen oxide and drilling holes at low points, add Nox-Rust 1200 to the water rinse. The Nox-Rust 1200 will deposit VCI to the surfaces. See recommendations on usage rates. Blank the inlet and product line	• Drain water lines completely and as an option to blowing dry and purging with nitrogen oxide and drilling holes at low points, add Nox-Rust 1200 to the water rinse. The Nox-Rust 1200 will deposit VCI to the surfaces. See recommendations on usage rates. Blank the inlet and product line
Air Coolers, Finned	• Drain all product from tubes and blow Nox-Rust VCI Powder (1000SF, 1000SFG or 1010SFG) • Grease and / or oil fans, gearboxes, etc. with Nox-Rust 3100 or Nox-Rust 7800 as applicable • Spray the exterior of metal fans with Nox-Rust 7800 between flanges of critical lines (marine applications spray all flanges) • Coat the threads of plugs with Nox-Rust 7800	• Drain all product from tubes and blow Nox-Rust VCI Powder (1000SF, 1000SFG or 1010SFG) • Grease and / or oil fans, gearboxes, etc. with Nox-Rust 3100 or Nox-Rust 7800 as applicable • Spray the exterior of metal fans with Nox-Rust 7800 between flanges of critical lines (marine applications spray all flanges) • Coat the threads of plugs with Nox-Rust 7800 • Drain the oil from gear reducer housing and refill it with Nox-Rust 7800 • Coat the exposed portions of shafts with Safecote A and wrap with Premium Metal-Guard or PC55D • Coat fan gears with Nox-Rust 3100 and wrap with Premium Metal-Guard or PC55D	• Drain all product from tubes and blow Nox-Rust VCI Powder (1000SF, 1000SFG or 1010SFG) • Grease and / or oil fans, gearboxes, etc. with Nox-Rust 3100 or Nox-Rust 7800 as applicable • Spray the exterior of metal fans with Nox-Rust 7800 between flanges of critical lines (marine applications spray all flanges) • Coat the threads of plugs with Nox-Rust 7800 • Drain the oil from gear reducer housing and refill it with Nox-Rust 7800 • Coat the exposed portions of shafts with Safecote A and wrap with Premium Metal-Guard or PC55D • Coat fan gears with Nox-Rust 3100 and wrap with Premium Metal-Guard or PC55D
Plate Exchangers	• Coat bolting with Nox-Rust 7800 or Safecote A	• Coat all valves with Safecote A • Coat all bolts and nuts with Safecote A	• Coat all valves with Safecote A • Coat all bolts and nuts with Safecote A
Shell and Tube Exchangers	• Drain water lines completely and as an option to blowing dry and purging with nitrogen oxide and drilling holes at low points, add Nox-Rust 1200 to the water rinse. The Nox-Rust 1200 will deposit VCI to the surfaces. See recommendations on usage rates. • Coat flange faces to the edges with Nox-Rust 7800 or Safecote A • Flush shell side and drain and as an option to blowing dry and purging with nitrogen oxide, add Nox-Rust 1200 to the water rinse. The Nox-Rust 1200 will deposit VCI to the surfaces. See recommendations on usage rates. • Coat drain valves, sample valves, etc. with Safecote A	• Drain water lines completely and as an option to blowing dry and purging with nitrogen oxide and drilling holes at low points, add Nox-Rust 1200 to the water rinse. The Nox-Rust 1200 will deposit VCI to the surfaces. See recommendations on usage rates. • Coat flange faces to the edges with Safecote A and seal all gaps with Premium Metal-Guard and Versil-Pak • Flush shell side and drain and as an option to blowing dry and purging with nitrogen oxide, add Nox-Rust 1200 to the water rinse. The Nox-Rust 1200 will deposit VCI to the surfaces. See recommendations on usage rates. • Coat drain valves, sample valves, etc. with Safecote A • Coat anchor bolts with Safecote A	• Drain water lines completely and as an option to blowing dry and purging with nitrogen oxide and drilling holes at low points, add Nox-Rust 1200 to the water rinse. The Nox-Rust 1200 will deposit VCI to the surfaces. See recommendations on usage rates. • Coat flange faces to the edges with Class Premium Metal-Guard Stretch and Versil-Pak • Flush shell side and drain and as an option to blowing dry and purging with nitrogen oxide, add Nox-Rust 1200 to the water rinse. The Nox-Rust 1200 will deposit VCI to the surfaces. See recommendations on usage rates. • Coat drain valves, sample valves, etc. with Nox-Rust 3100 • Coat anchor bolts with Nox-Rust 3100

Storage Tanks	1-18 Month Protection Program	18-60 Month Protection Program	+60 Month Protection Program
	• 6-12 months - Empty tanks may be coated with Nox-Rust 7800 • Protect insides with either Nox-Rust VCI Powder, Nox-Rust 1200 or Nox-Rust 1100 • +12 months - Coat with Nox-Rust 7800	• Coat with Safecote A • Add Nox-Rust 1200 to water-based (and Nox-Rust 1100 to oil-based) internals • In marine or severe industrial environments, cover gaps at flanges or other openings with Premium Metal-Guard Stretch Wrap and Versil-Pak • Protect insides with either Nox-Rust VCI Powder, Nox-Rust 1200 or Nox-Rust 1100 • Coat all flanges faces out to the edges with Safecote A • Protect insides with either Nox-Rust VCI Powder, Nox-Rust 1200 or Nox-Rust 1100	• Coat with Safecote A • Add Nox-Rust 1200 to water-based (and Nox-Rust 1100 to oil-based) internals • In marine or severe industrial environments, cover gaps at flanges or other openings with Premium Metal-Guard Stretch Wrap and Versil-Pak • Protect insides with either Nox-Rust VCI Powder, Nox-Rust 1200 or Nox-Rust 1100 • Coat all flanges faces out to the edges with Safecote A • Protect insides with either Nox-Rust VCI Powder, Nox-Rust 1200 or Nox-Rust 1100

Rotating Equipment	1-18 Month Protection Program	18-60 Month Protection Program	+60 Month Protection Program
Centrifugal Pumps	• Drain completely and as an option to blowing dry and purging with nitrogen oxide, add Nox-Rust 1200 to the water rinse. The Nox-Rust 1200 will deposit VCI to the surfaces. See recommendations on usage rates. • Fill pump casing with Nox-Rust 7800 • Spray pump shafts with Nox-Rust 7800	• Drain completely and as an option to blowing dry and purging with nitrogen oxide, add Nox-Rust 1200 to the water rinse. The Nox-Rust 1200 will deposit VCI to the surfaces. See recommendations on usage rates. • Fill pump casing with Nox-Rust 1100 and rotate the pump shaft to ensure complete oil coverage • Coat the exposed portions of shafts with Safecote A and wrap with Premium Metal-Guard Stretch and Versil-Pak • Plug the bearing housing drains and fill the housings with Nox-Rust 1100, close all vents • Fill shaft couplings with Nox-Rust 3100	• Drain completely and as an option to blowing dry and purging with nitrogen oxide, add Nox-Rust 1200 to the water rinse. The Nox-Rust 1200 will deposit VCI to the surfaces. See recommendations on usage rates. • Fill pump casing with Nox-Rust 1100 and rotate the pump shaft to ensure complete oil coverage • Coat the exposed portions of shafts with Safecote A and wrap with Premium Metal-Guard Stretch and Versil-Pak • Plug the bearing housing drains and fill the housings with Nox-Rust 1100, close all vents • Fill shaft couplings with Nox-Rust 3100
Reciprocating Pumps	• Fill both sides of the pump with Nox-Rust 7800 • Fill lubricators with Nox-Rust 7800	• Fill both sides of the pump with Nox-Rust 1100 • Fill lubricators with Nox-Rust 1100 • Coat all valves with Safecote A • Coat exposed rods and other machined surfaces with Nox-Rust Safecote A and wrap with Premium Metal-Guard Stretch and Versil-Pak	• Fill both sides of the pump with Nox-Rust 1100 • Fill lubricators with Nox-Rust 1100 • Coat all valves with Safecote A • Coat exposed rods and other machined surfaces with Safecote A and wrap with Premium Metal-Guard Stretch and Versil-Pak
Mechanical Seals and Packaging		• For single seals, pack the seal with Nox-Rust 3100 • Plug the lower stuffing box drain and fill the stuffing box with Nox-Rust 7800 or Nox-Rust 3100 • Coat the interior of the stuffing box with 3100	• For single seals, pack the seal with Nox-Rust 3100 • Plug the lower stuffing box drain and fill the stuffing box with Nox-Rust X-285 (7800) or Nox-Rust 3100 • Coat the interior of the stuffing box with 3100
Bearings - All Equipment	• Drain oil filled bearings then fill with Nox-Rust 7800	• Drain oil filled bearings then fill with Nox-Rust 7800 • Pump greased bearings full of Nox-Rust 3100	• Drain oil filled bearings then fill with Nox-Rust 1100 • Pump greased bearings full of Nox-Rust 3100
Drives	• Drain gear cases and fill to operating level with Nox-Rust 7800 • Open gears, sprockets, screws, chain drives and coat with Nox-Rust 3100	• Drain gear cases and fill to operating level with Nox-Rust 7800, run for 10 minutes, seal with Nox-Rust 1100 • Open gears, sprockets, screws, chain drives and coat with Nox-Rust 3100 • On v-belt drives, remove belts and store indoors, coat sheaves with Nox-Rust 3100	• Drain gear cases and fill to operating level with Nox-Rust 7800, run for 10 minutes, seal with Nox-Rust 1100 • Open gears, sprockets, screws, chain drives and coat with Nox-Rust 3100 or Nox-Rust 3100 • On v-belt drives, remove belts and store indoors, coat sheaves with Nox-Rust 3100
Couplings	• Clean and coat couplings with Nox-Rust 3100 • Fill lubricators with Nox-Rust 7800	• Clean and coat couplings with Nox-Rust 3100 and cover with Premium Metal-Guard or PC55D • Fill lubricators with Nox-Rust 7800 • Drain oil filled couplings then fill with Nox-Rust 7800	• Clean and coat couplings with Nox-Rust 3100 and cover with Premium Metal-Guard or PC55D • Add Nox-Rust 1100 to the lubricators • Add Nox-Rust 1100 to oil filled couplings

Continued

Agitators, Centrifuges and Mixers	• Blow Nox-Rust VCI Powder (1000SF, 1000SFG or 1010SFG) inside of vessel and seal all openings with Versil-Pak or Premium Metal-Guard • Clean flanges and coat Nox-Rust 7800 or Safecote A depending on length of shutdown • Coat bolts and nuts with Nox-Rust 7800 or Safecote A, depending on length of shutdown	• Blow Nox-Rust VCI Powder (1000SF, 1000SFG or 1010SFG) inside of vessel and seal all openings with Versil-Pak or Premium Metal-Guard • Clean flanges and coat with Safecote A • Coat bolts and nuts with Safecote A	• Blow Nox-Rust VCI Powder (1000SF, 1000SFG or 1010SFG) inside of vessel and seal all openings with Versil-Pak or Premium Metal-Guard • Clean flanges and coat with Safecote A • Coat bolts and nuts with Safecote A
Hydraulic Systems, Lubricating Oil Systems and Oil Reserviors	• Drain systems and fill to operating level using Nox-Rust 7800 • On critical items, Nox-Rust 1100 may be substituted	• Drain systems and fill to operating level using Nox-Rust 7800 or Nox-Rust 1100 • On critical items, use Nox-Rust 1100	• Drain systems and fill to operating level using Nox-Rust 7800 or Nox-Rust 1100 • On critical items, use Nox-Rust 1100

Compressors			
	1-18 Month Protection Program	**18-60 Month Protection Program**	**+60 Month Protection Program**
Centrifugal or Rotary	• Spray Nox-Rust 1100 into the suction line as the machine is rotated slowly • Fill casings and oil systems with Nox-Rust 1100 • Coat exposed machine surfaces with Safecote A	• Remove the rotor, bear and seals, clean the components and put into waterproof Premium Metal-Guard or PC55D • Fill casings and oil systems with Nox-Rust 1100 • Coat exposed machine surfaces with Safecote A	• Remove the rotor, bear and seals, clean the components and put into waterproof Premium Metal-Guard or PC55D • Fill casings and oil systems with Nox-Rust 1100 • Coat exposed machine surfaces with Safecote A
Reciprocating	• Add Nox-Rust 1100 to crankcase fluids • Coat exposed machine surfaces with Safecote A • Drain tanks and receivers, insert Nox-Rust VCI Powder (1000SF, 1000SFG or 1010SFG) and seal all openings with Versil-Pak or Premium Metal-Guard	• Add Nox-Rust 1100 to crankcase fluids • Coat any exposed machine surface with Safecote A • Drain tanks and receivers, insert Nox-Rust VCI Powder (1000SF, 1000SFG or 1010SFG) and seal all openings with Versil-Pak or Premium Metal-Guard	• Add Nox-Rust 1100 to crankcase fluids • Add Nox-Rust 1100 to lubricators • Coat any exposed machine surface with Nox-Rust 3100 • Drain tanks and receivers, insert Nox-Rust VCI Powder (1000SF, 1000SFG or 1010SFG) and seal all openings with Versil-Pak or Premium Metal-Guard

Steam Turbines			
	1-18 Month Protection Program	**18-60 Month Protection Program**	**+60 Month Protection Program**
	• Fog the steam spaces with Nox-Rust VCI Powder (1000SF, 1000SFG or 1010SFG), turning rotor as the is blown in • Protect bearings as previously in this section under Rotating Equipment • Pack gears or other drive mechanisms with Nox-Rust 3100 • Fill shaft coupling with Nox-Rust 3100 and wrap it with Premium Metal-Guard or PC55D • Protect lubricating and seal oil systems as previously in this section under Rotating Equipment	• Fog the steam spaces with Nox-Rust VCI Powder (1000SF, 1000SFG or 1010SFG), turning rotor as the is blown in • Protect bearings as previously in this section under Rotating Equipment • Pack gears or other drive mechanisms with Nox-Rust 3100 • Fill shaft coupling with Nox-Rust 3100 and wrap it with Premium Metal-Guard or PC55D • Protect lubricating and seal oil systems as previously in this section under Rotating Equipment • Coat any exposed machine surface with Safecote A	• Fog the steam spaces with Nox-Rust VCI Powder (1000SF, 1000SFG or 1010SFG), turning rotor as the is blown in • Protect bearings as previously in this section under Rotating Equipment • Pack gears or other drive mechanisms with Nox-Rust 3100 • Fill shaft coupling with Nox-Rust 3100 and wrap it with Premium Metal-Guard or PC55D • Protect lubricating and seal oil systems as previously in this section under Rotating Equipment • Coat any exposed machine surface with Nox-Rust 3100

Electrical Equipment

	1-18 Month Protection Program	18-60 Month Protection Program	+60 Month Protection Program
Motors-Field Storage	• Drain oil-lubricated bearings and fill them with Nox-Rust 7800 oil • Coat exposed shafts with Nox-Rust 7800 or Safecote A	• Drain oil-lubricated bearings and fill them with Nox-Rust 1100 oil • Coat exposed shafts with Safecote A and wrap shafts with Premium Metal-Guard or PC55D • Add Nox-Rust 1100 to the oil-lubricated bearings • Fill grease-type bearings with Nox-Rust 3100	• Drain oil-lubricated bearings and fill them with Nox-Rust 1100 oil • Coat exposed shafts with Safecote A and wrap shafts with Premium Metal-Guard or PC55D • Add Nox-Rust 1100 to the oil-lubricated bearings • Fill grease-type bearings with Nox-Rust 3100 • On large motors remove brushes or collector rings or lift them and insert between the item and the metal and Premium Metal-Guard or PC55D
Motors-Disassembled		• Coat all shafts with Safecote A and wrap with poly coated Premium Metal-Guard or PC55D • Coat all exposed surfaces with Safecote A • Cover with Premium Metal-Guard or PC55D as dust and corrosion protection	• Coat all shafts with Nox-Rust 3100 and wrap with Premium Metal-Guard or PC55D • Coat all exposed surfaces with Nox-Rust 3100 • Cover with Premium Metal-Guard or PC55D as dust and corrosion protection
Vertical Motors		• Fill bearings with Nox-Rust 7800 or Nox-Rust 3100 • Coat all exposed surfaces with Safecote A	• Fill bearings Nox-Rust 3100 • Coat exposed machined surfaces with Nox-Rust 3100
Transformers	• Install Daubrite Emitters (D1, D5 or D10) in receptacles or other locations • Place Daubrite Emitters in cabinets of switchgear and motor controls located in buildings • Protect outdoor controls with Premium Metal-Guard X-O Wrap and seal the cases	• Install Daubrite Emitters (D1, D5 or D10) in receptacles or other locations • Place Daubrite Emitters in cabinets of switchgear and motor controls located in buildings • Protect outdoor controls with Premium Metal-Guard X-O Wrap and seal the cases	• Install Daubrite Emitters (D1, D5 or D10) in receptacles or other locations • Place Daubrite Emitters in cabinets of switchgear and motor controls located in buildings • Protect outdoor controls with Premium Metal-Guard X-O Wrap and seal the cases • Protect small equipment such as relays, circuitry breakers, push buttons by placing them in Premium Metal-Guard bags

Control Devices and Instrumentation

	1-18 Month Protection Program	18-60 Month Protection Program	+60 Month Protection Program
Pneumatic Systems	• Daubrite Emitters (D1, D5 or D10)	• Daubrite Emitters (D1, D5 or D10)	• Daubrite Emitters (D1, D5 or D10)
Control Valves	• Daubrite Emitters (D1, D5 or D10)	• Daubrite Emitters (D1, D5 or D10) • Coat all seating surfaces with Safecote A • Coat bores of valves,flange faces, weld preparation areas and other machined surfaces and cavity bodies with Safecote A • Seal all ports with plugs lined with Premium Metal-Guard or PC55D and insert Daubrite emitters for large openings • Add Nox-Rust 1100 to piston actuators	• Daubrite Emitters (D1, D5 or D10) • Coat all seating surfaces with Safecote A • Coat bores of valves, flange faces, weld preparation areas and other machined surfaces and cavity bodies with Safecote A • Seal all ports with plugs lined with Premium Metal-Guard or PC55D and insert Daubrite emitters for large openings • Add Nox-Rust 1100 to piston actuators
Pressure Relief Valves		• Coat springs with Safecote A • Coat flange faces to the edges with Safecote A and seal all gaps with Premium Metal-Guard and Versil-Pak or VCI Poly • Coat valve cavities with Nox-Rust 3100	• Coat springs with Safecote A • Coat flange faces to the edges with Nox-Rust 3100 and seal all gaps with Premium Metal-Guard and Versil-Pak or VCI Poly • Coat valve cavities with Nox-Rust 3100
Temperature Gage		• Fit plugs coated with Safecote A into couplings in the field	• Fit plugs coated with Nox-Rust 3100 into couplings in the field
Field Panels		• Insert Daubrite Emitters (D1, D5 or D10) in the panels	• Insert Daubrite Emitters (D1, D5 or D10) in the panels • Cover panels with Premium Metal-Guard or PC55D

DAUBERT CROMWELL
The Leading Name in Corrosion Prevention®

Fire Heater and Furnaces

	1-18 Month Protection Program	18-60 Month Protection Program	+60 Month Protection Program
	• Grease door and other opening hinges with Nox-Rust 3100 • Protect burners by wrapping with Premium Metal-Guard or PC55D	• Grease door and other opening hinges with Nox-Rust 3100 • Protect burners by wrapping with Premium Metal-Guard or PC55D • Cap duct openings after coating ducts with Nox-Rust 3100	• Grease door and other opening hinges with Nox-Rust 3100 • Protect burners by wrapping with Premium Metal-Guard or PC55D • Cap duct openings after coating ducts with Nox-Rust 3100

Diesel and Gasoline Engines

	1-18 Month Protection Program	18-60 Month Protection Program	+60 Month Protection Program
	• Fill lubricators with Nox-Rust 7800 • Re-prime exterior surfaces and coat machined surfaces with Nox-Rust 7800 or Nox-Rust 3100	• Fill lubricators with Nox-Rust 1100 • Re-prime exterior surfaces and coat machined surfaces with Safecote A and wrap with Premium Metal-Guard or PC55D • Seal all openings, coat flanges with Safecote A before sealing	• Fill lubricators with Nox-Rust 1100 • Re-prime exterior surfaces and coat machined surfaces with Safecote A and wrap with Premium Metal-Guard or PC55D • Seal all openings, coat flanges with Safecote A before sealing • Spray the manifolds with Nox-Rust 1100 and cap with Premium Metal-Guard or PC55D

Lined Tanks and Vessels

	1-18 Month Protection Program	18-60 Month Protection Program	+60 Month Protection Program
Thin or Baked Linings		• Coat exposed steel with Safecote A • Coat bolts and nuts with Safecote A	• Coat exposed steel with Nox-Rust 3100 and cap off with Premium Metal-Guard or PC55D • Coat bolts and nuts with Nox-Rust 3100
Thick or Free-Standing Lining		• Coat exposed steel with Safecote A	• Coat exposed steel with Nox-Rust 3100 and cap off with Premium Metal-Guard or PC55D
Brick Lined Vessels	• Coat exposed steel with Safecote A • Coat bolts and nuts with Safecote A	• Coat exposed steel with Safecote A • Coat bolts and nuts with Safecote A	• Coat exposed steel with Nox-Rust 3100 and cap off with Premium Metal-Guard or PC55D • Coat bolts and nuts with Nox-Rust 3100

Refrigeration Systems

	1-18 Month Protection Program	18-60 Month Protection Program	+60 Month Protection Program
	• Pumps, compressors, chillers, condensers, etc., as previously described	• Pumps, compressors, chillers, condensers, etc., as previously described • Coat exposed steel with Safecote A • Coat bolts and nuts with Safecote A • Add Nox-Rust 1100 to chiller coil	• Pumps, compressors, chillers, condensers, etc., as previously described • Coat exposed steel with Nox-Rust 3100 and cap off with Premium Metal-Guard or PC55D • Coat bolts and nuts with Safecote A • Add Nox-Rust 1100 to chiller coil

Control Rooms

	1-18 Month Protection Program	18-60 Month Protection Program	+60 Month Protection Program
	• Daubrite Emitters (D1, D5 or D10) in each cabinet	• Daubrite Emitters (D1, D5 or D10) in each cabinet	• Daubrite Emitters (D1, D5 or D10) in each cabinet

Expansion Joints

	1-18 Month Protection Program	18-60 Month Protection Program	+60 Month Protection Program
	• Coat end rings, retaining rings and associated hardware with Nox-Rust 7800 or Safecote A • On flanged joints, open and clean the flanges and coat with Nox-Rust 7800 or Safecote A	• Coat end rings, retaining rings and associated hardware with Safecote A • On flanged joints, open and clean the flanges and coat with Safecote A • Wrap gaps and exposed surfaces with Premium Metal-Guard or PC55D as appropriate	• Coat end rings, retaining rings and associated hardware with Safecote A • On flanged joints, open and clean the flanges and coat with Safecote A • Wrap gaps and exposed surfaces with Premium Metal-Guard or PC55D

Sprinkler Systems			
	1-18 Month Protection Program	18-60 Month Protection Program	+60 Month Protection Program
		• Wrap heads with Premium Metal-Guard or PC55D	• Wrap heads with Premium Metal-Guard or PC55D

Warehouse and Storage Yard			
	1-18 Month Protection Program	18-60 Month Protection Program	+60 Month Protection Program
Warehouse Items	• Coat all machined surfaces on carbon and low alloy steel components with Nox-Rust 7800 • Mating low flanges bolt faced-to-face are separated, coated with Nox-Rust 7800 or Safecote A and reassembled • Use Premium Metal-Guard or PC55D in place of burlap or corrugated separators • Grease gears, shafts with Nox-Rust 3100 • Coat flange faces of valves, pumps, etc., with Nox-Rust 7800 or Nox-Rust Safecote A and cover with hardwood like plywood • Place Daubrite Emitters (D1, D5 or D10) in electrical cabinets, relay cabinets, etc. cover with Premium Metal-Guard • Grease and / or oil valves, valve stems and similar components with Nox-Rust 3100 or Safecote A	• Coat all machined surfaces on carbon and low alloy steel components with Safecote A • Mating low flanges bolt faced-to-face are separated, coated with Safecote A and reassembled • Use Premium Metal-Guard or PC55D in place of burlap or corrugated separators • Grease gears, shafts with Nox-Rust 3100 • Coat flange faces of valves, pumps, etc., with Safecote A and cover with hardwood like plywood • Place Daubrite Emitters (D1, D5 or D10) in electrical cabinets, relay cabinets, etc. cover with Premium Metal-Guard • Grease and / or oil valves, valve stems and similar components with Nox-Rust 3100 or Safecote A and wrap with Premium Metal-Guard or PC55D	• Coat all machined surfaces on carbon and low alloy steel components with Safecote A • Mating low flanges bolt faced-to-face are separated, coated with Safecote A and reassembled • Use Premium Metal-Guard or PC55D in place of burlap or corrugated separators • Grease gears, shafts with Nox-Rust 3100 • Coat flange faces of valves, pumps, etc., with Safecote A and cover with hardwood like plywood • Place Daubrite Emitters (D1, D5 or D10) in electrical cabinets, relay cabinets, etc. cover with Premium Metal-Guard • Grease and / or oil valves, valve stems and similar components with Nox-Rust 3100 or Safecote A and wrap with Premium Metal-Guard or PC55D
Storage Yard	• Wrap and package miscellaneous metal parts and components with Premium Metal-Guard or PC55D (indoors) or Premium Metal-Guard X-O Wrap (exterior)	• Wrap and package miscellaneous metal parts and components with Premium Metal-Guard or PC55D (indoors) or Premium Metal-Guard X-O Wrap (exterior)	• Wrap and package miscellaneous metal parts and components with Premium Metal-Guard or PC55D (indoors) or Premium Metal-Guard X-O Wrap (exterior)

Contact Inhibitors

Listed by General Classification and Term of Storage (shorter to longer term)

CLASSIFICATION: Oil Films

Class II-Petroleum based oil

Typically SAE 20-30 viscosity (300-500 SUS at 100F) used to protect gearboxes, crankcases, bearings and housings, and other machinery that normally would be lubricated during operation. The material does not have to be removed from the surfaces when normal lubricating oil is reintroduced.

Nox-Rust 7800

Preparation, Application & Removal:

Preparation: Surface should be dry and free (clean) of any soils or other contaminants prior to coating application.

Application: Flush, dip spray or brush. Available in 5-gallon pails and 55 gallon drums. (Refer to TDS for additional details on dry times if applicable).

Removal: Rarely required unless metal needs to be painted, etc., otherwise use petroleum solvents.

Product Notes:

Purpose: Provides both corrosion protection and excellent lubrication. Used to protect high precision equipment, assemblies and parts.

Film Type: Petroleum film, light amber in color with a SUS of 66-70 at 100˚F

	TERMS OF STORAGE										
Type	0m	1m	3m	6m	9m	1yr	2yr	3yr	4yr	5yr	10+yr
Indoor											
Outdoor Covered	Not recommended										
Outdoor Uncovered	Not recommended										

Nox-Rust 5300

Preparation, Application & Removal:

Preparation: Surface should be dry and free (clean) of any soils or other contaminants prior to coating application.

Application: May be applied down to 40˚F. 0.4 mil (0.010 mm) setting time in about 30-45 minutes. Available in 11 oz. aerosol spray, 5-gallon pails and 55 gallon drums. (Refer to TDS for additional details on dry times if applicable).

Removal: Conventional cleaning procedures or petroleum solvents, alkali or emulsion cleaners.

Product Notes:

Purpose: Need to displace water or saline solution from corrodible surfaces. May be used to protect interior surfaces of machinery.

Film Type: Brown colored, oily film

	TERMS OF STORAGE										
Type	0m	1m	3m	6m	9m	1yr	2yr	3yr	4yr	5yr	10+yr
Indoor											
Outdoor Covered											
Outdoor Uncovered	Not recommended										

CLASSIFICATION: Grease Films

Class III-Emulsion

Petroleum based product that forms a very thin film, dry skin on the surface while underneath the product remains soft and sticky. The coating will expand and contract with the metal without cracking. For critical equipment, wrapping may be necessary to prevent mechanical damage.

Safecote A

Preparation, Application & Removal:

Preparation: Surface should be dry and free (clean) of any soils or other contaminants prior to coating application.

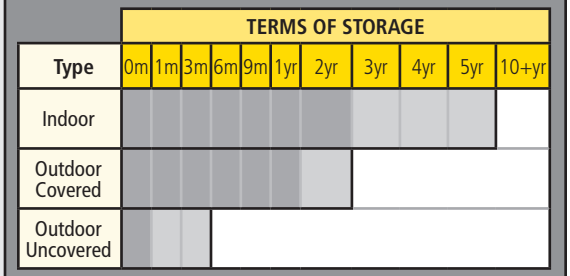
Application: May be applied down to 40˚F. Available in 11 oz. aerosol spray, 5-gallon pails and 55 gallon drums. (Refer to TDS for additional details on dry times if applicable).

Removal: Conventional cleaning procedures or petroleum solvents, alkali or emulsion cleaners.

Product Notes:

Purpose: Apply as a final preservative coating for storage and shipment. Excellent inhibiting high humidity and salt spray protection.

Film Type: Brown colored, grease-like.



Class I-Solvent

After application, the solvent evaporates as the drying mechanism, leaving a thin, evenly distributed film. Generally self healing, the film displaces moisture and inhibits fingerprint acids on machined surfaces. It may be applied to parts that are damp from soluble cutting oils or atmospheric moisture. It may also be used to dry parts prior to coating with compatible compounds from other classes or preservatives. As the film is extremely thin, its removal is generally not necessary before returning equipment to service. The consistency of material in this class may vary from thin liquid to semi-viscous liquid depending on the preservative chosen. Specification reference: MIL-C-16173D Grade II and MIL-P-116 Type 2

Nox-Rust 5200

Preparation, Application & Removal:

Preparation: Surface should be dry and free (clean) of any soils or other contaminants prior to coating application.

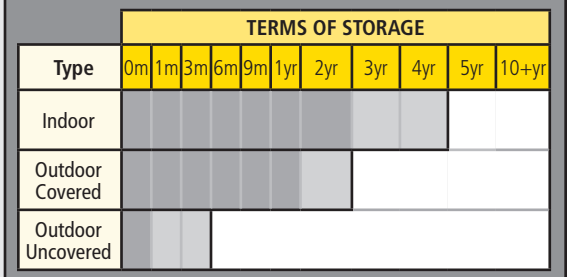
Application: May be applied down to 40˚F. Available in 11 oz. aerosol spray, 5-gallon pails and 55 gallon drums. (Refer to TDS for additional details on dry times if applicable).

Removal: Conventional cleaning procedures or petroleum solvents, alkali or emulsion cleaners.

Product Notes:

Purpose: Long term protection primarily for indoor conditions.

Film Type: Brown colored, grease-like.



CLASSIFICATION: Wax Films

Class V-Hard Film

These products dry by solvent evaporating and leaving a hard, tough surface which may feel somewhat waxy. The quality of the protection depends both on the integrity of the coating and the cleanliness of the surface that it is applied. Most often used on non-precision parts. Removal is difficult requiring steam and detergents followed by mineral spirits or possibly sandblasting in extreme situations. At times airborne dust, sand and debris may attach creating a hardened shell while the metal beneath is fully protected from corrosion. Specification reference: MIL-C-16173D Grade I and MIL-P-116E Type P-1

Nox-Rust 3100

Preparation, Application & Removal:

PPreparation: Surface should be dry and free (clean) of any soils or other contaminants prior to coating application.

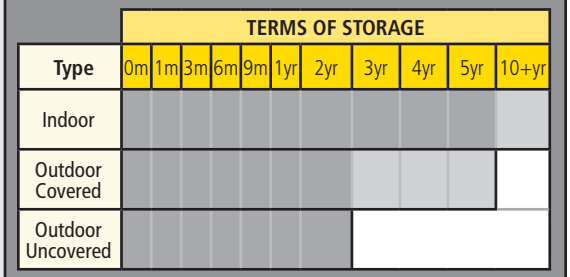
Application: May be applied down to 40˚F. 3.0-4.0 mil (xx mm) will dry in 1-2 hour to 1.5-2.0 mil thickness. Coverage is 700 sq ft per gallon. Cumulative 1 mil layers may be applied with subsequent layers after each dry time. Available in 11 oz. aerosol spray, 5-gallon pails and 55 gallon drums.

Removal: Mineral spirits or kerosene soaked towels and / or vapor degreasing.

Product Notes:

Purpose: Excellent long term storage corrosion inhibitor

Film Type: Dark brown liquid dries to amber semi-transparent, wax-like film.



Volatile Corrosion Inhibitors (VCI)

Listed by General Classification and Term of Storage (shorter to longer term)

CLASSIFICATION: VCI Liquids

Oil Based

VCIs (volatile corrosion inhibitors) are included in a petroleum based liquid and are used in a "closed" system such as internals of engines, storage tanks and transmissions. It may be added to diesel, gasoline, oil, and hydraulics as a final step prior to decommissioning the equipment. Once added it will mix with the existing liquid and then vaporize to reach the unprotected metal above the liquid line.

Nox-Rust 1100

Preparation, Application & Removal:

Product Notes:

Nox-Rust 1100 is added to the internals as an additive to the liquids resident. Prescribed amounts added described in detail on data sheets. Add as late as possible to avoid it being blown out of the closed system. Available in 11 oz. aerosol and 5 gallon and 55 gallon containers.

	TERMS OF STORAGE										
Type	0m	1m	3m	6m	9m	1yr	2yr	3yr	4yr	5yr	10+yr
Closed System											

Water Based

VCI (volatile corrosion inhibitors) are included in water that allows it to be added to the closed system of equipment such as water lines, water storage tanks and boilers. It is also used as hydro testing water. When the VCI added to the water, it will protect while the water is in contact with the metal and will volatize from the water to protect the metal above the water line.

Nox-Rust 1200

Preparation, Application & Removal:

Product Notes:

Nox-Rust 1200 is a silica free, water soluble liquid that when added to a closed system will provide VCI protection above the water line. Available in 5 gallon pails and 55 gallon drums.

	TERMS OF STORAGE										
Type	0m	1m	3m	6m	9m	1yr	2yr	3yr	4yr	5yr	10+yr
Closed System											

CLASSIFICATION: VCI Papers

VCI Coated

Papers coated "only" with VCI are available in various type of steel variety, protection terms and paper strengths. These combinations provide a wide variety of products used for individually wrapping parts, interleaving between parts in bulk packaging or augmenting VCI products such as VCI Poly products to add volume and distribution of VCI. VCI is intended to be used in closed spaces and will provide Intermediate (1-2 years) to Long-Term (2-10 years) protection provided metal preparation and packaging design are appropriate.

Refer to Product Notes below for Daubert Cromwell product options

Preparation, Application & Removal:

Preparation: Surface should be dry and free (clean) of any soils or other contaminants prior to packaging.

Product Notes:

Ferrous metal, long-term protection: Nox-Rust Vapor Wrapper (VW35D, VW35DH, VW60D, VW60DH, VW100D),

Ferrous metal, intermediate-term protection: Protek Wrap (PW30, PW30H, 30F, PW32, PW32H, 35F, PW60, PW60H, 60F),

Galvanized metal protection: Ferro-Galv (30FG, 35FG, 40FG, 60FG),

Mil-Spec (4060, VW60H, 7090), Multi-metal protection: Uniwrap MPI (UW30MPI, UW35MPI, UW200, UW40MPI, UW60MPI)

	TERMS OF STORAGE										
Type	0m	1m	3m	6m	9m	1yr	2yr	3yr	4yr	5yr	10+yr
Indoor											
Outdoor Covered	Not recommended										
Outdoor Uncovered	Not recommended										

VCI and Barrier Coated

VCI coated papers with barrier coatings most commonly include poly or wax on the opposite side of the VCI coated side. The intention of the barrier is to restrict the contaminants from entering the space and to the metal. These products are most commonly used when harsh environments due to long term protection are needed or where other packaging materials such as corrugated and lumber are sources for contamination. Barrier materials are also used to keep greases and liquids inside the package (bearings, etc.) to protect those fluids from leaching into other packaging materials such as crates and boxes.

Refer to Product Notes below for Daubert Cromwell product options

Preparation, Application & Removal:

Preparation: Surface should be dry and free (clean) of any soils or other contaminants prior to packaging.

Product Notes:

Ferrous metal, long-term protection: Nox-Rust Vapor Wrapper (PC55D, PC75D),

Ferrous metal, intermediate-term protection: Protek Wrap (PW33, 60PCF),

Multi-metal protection: Uniwrap MPI (UW33MPI, 40PCMPI, 60PCMPI)

	TERMS OF STORAGE										
Type	0m	1m	3m	6m	9m	1yr	2yr	3yr	4yr	5yr	10+yr
Indoor											
Outdoor Covered	Not recommended										
Outdoor Uncovered	Not recommended										

VCI and Barrier Coated and Reinforced

When high strength is required VCI papers with reinforced fibers are used. Most often they include a poly coating layer than sandwiches a fibrous yarn or poly weave material. Reinforced VCI papers are useful for wrapping large bulky items such as equipment and steel coil providing VCI protection on the inside of the packaging material and barrier from the environment on the outside.

Refer to Product Notes below for Daubert Cromwell product options

Preparation, Application & Removal:

Preparation: Surface should be dry and free (clean) of any soils or other contaminants prior to packaging.

Product Notes:

Ferrous metal, intermediate-term protection: Protek Wrap (PC50H Scrim)

Galvanized metal protection: Ferro-Galv (Woven Ferro-Galv),

Multi-metal protection: Uniwrap MPI (UW94MPI, PC50MPI Scrim, Steelwrap MPI)

	TERMS OF STORAGE										
Type	0m	1m	3m	6m	9m	1yr	2yr	3yr	4yr	5yr	10+yr
Indoor											
Outdoor Covered	Not recommended										
Outdoor Uncovered	Not recommended										

Other

A variety of specialty VCIs are available for specialized applications including some specific to the metal such as copper, silver and aluminum. VCI papers may also be creped for added strength.

Refer to Product Notes below for Daubert Cromwell product options

Preparation, Application & Removal:

Preparation: Surface should be dry and free (clean) of any soils or other contaminants prior to packaging.

Product Notes:

Specialty metal: Coppertex (CPTX, CPTX60), Alumitex, Silver Saver

	TERMS OF STORAGE										
Type	0m	1m	3m	6m	9m	1yr	2yr	3yr	4yr	5yr	10+yr
Indoor											
Outdoor Covered	Not recommended										
Outdoor Uncovered	Not recommended										

CLASSIFICATION: VCI Poly

VCI Only

VCI Poly products that are intended for indoor use or under cover such as an overseas crate. Formulations vary by type of steel protection and strengths of the poly. Most commonly used is 4.0 mil thick film but will vary (2.0-6.0 mil) for this purpose of increasing strength or reducing cost. VCI Poly is easy to work with as it is heat sealable as any HDPE and can be made into bags and shrouds. The product is also available as a 1 mil stretchable film. While the poly provides a good barrier for indoor packaging it needs to be understood by the user that the amount of VCI in a poly is less than and takes more vapor pressure and time to release than other forms of VCI carriers such as VCI paper and certain VCI Devices. For this reason it is important to consider the Packaging Design when using VCI Poly to accomplish the goals of term of storage.

Refer to Product Notes below for Daubert Cromwell product options

Preparation, Application & Removal:

Preparation: Surface should be dry and free (clean) of any soils or other contaminants prior to packaging.

Product Notes:

Ferrous metal, intermediate-term protection: Ferro-Film, Premium Metal-Guard, Clear Pak 2000,

Multi-metal protection: Premium Metal-Guard, Premium Metal-Guard Stretch Film, Clear Pak 3000,

	TERMS OF STORAGE										
Type	0m	1m	3m	6m	9m	1yr	2yr	3yr	4yr	5yr	10+yr
Indoor											
Outdoor Covered	Not recommended										
Outdoor Uncovered	Not recommended										

VCI and Other

VCI Poly is available in high strength forms, either by modifying the polymers used or by weaving and or laminating the polymers. They may also be upgraded to provide great heat shrinkage or protection from UV light. While the poly provides a good barrier for indoor packaging it needs to be understood by the user that the amount of VCI in a poly is less than and takes more vapor pressure and time to release than other forms of VCI carriers such as VCI paper and certain VCI Devices. For this reason it is important to consider the Packaging Design when using VCI Poly to accomplish the goals of term of storage.

Refer to Product Notes below for Daubert Cromwell product options

Preparation, Application & Removal:

Preparation: Surface should be dry and free (clean) of any soils or other contaminants prior to packaging.

Product Notes:

All poly fabric for ferrous metal, intermediate-term protection: Nox-Rust Poly Wrap

Outdoor protection (UV stabilized) protection and heat shrinkable: Premium Metal-Guard X-O Wrap (multi-metal), Ferro Film X-O Wrap (ferrous metal),

	TERMS OF STORAGE										
Type	0m	1m	3m	6m	9m	1yr	2yr	3yr	4yr	5yr	10+yr
Indoor											
Outdoor Covered									X-O Wrap Only		
Outdoor Uncovered								X-O Wrap Only			

CLASSIFICATION: VCI Devices

VCI Powders

VCI Powders are used in closed systems where corrosion protection is needed but typical VCI packaging material cannot be used or where spraying a VCI liquid is not desirable. The VCI Powder works well in spray applications or it may be added to water at prescribed rates for hydro testing applications. Inside pipe protection is also a common use of the product.

Nox-Rust VCI Powder (1000SF, 1000SFG or 1010SFG)

Preparation, Application & Removal:

Product Notes:

Nox-Rust VCI Powder 1000SF is silica free, water soluble for ferrous metals, 1000SFG is similar but a fine grind. 1010SFG is also copper compatible. Product sold in 5 Lbs., 25 Lbs., and 150 Lbs. containers. New is the VCI Powder Pouch that can be used to blow the VCI Powder into a 10' x 10' x 10' using a standard fan to dispense the vapors.

	TERMS OF STORAGE										
Type	0m	1m	3m	6m	9m	1yr	2yr	3yr	4yr	5yr	10+yr
Closed System											

VCI Emitting Devices

VCI Emitters are high concentrations of VCI in a small device that can be located near the metals where traditional packaging materials will not be appropriate. Carriers such as foam, woven bond, or chipboard are commonly used. Some devices have double backed tape that allows them to be placed inside electrical cabinets and enclosures, where critical assets need extended operating life. They are also used to augment typical packaging where larger amounts of VCI are needed.

Daubrite Emitters (D1 Packet, D5 & D10 Discs, D3 Foam)

Preparation, Application & Removal:

Preparation: Surface should be dry and free (clean) of any soils or other contaminants prior to packaging.

Product Notes:

Daubrite 1 Emitters are packets similar looking to desiccants while the D5 and D10 are saturated woven bond pads with double backed tape for easy installation in electrical enclosures. D3 Foam is also adhesive backed and like the D5 and D10 have NSNs for government purchases.

	TERMS OF STORAGE										
Type	0m	1m	3m	6m	9m	1yr	2yr	3yr	4yr	5yr	10+yr
Indoor											
Outdoor Covered	Not recommended										
Outdoor Uncovered	Not recommended										

CLASSIFICATION: Multi Component Systems

Class VIII

VCI products are applicable indoors and outdoors, with other barrier materials and packaging environments.

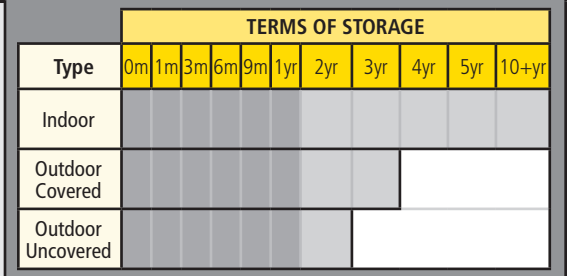
Premium Metal-Guard Stretch Film and Versil-Pak combination

Preparation, Application & Removal:

Preparation: Surface should be dry and free (clean) of any soils or other contaminants prior to packaging.

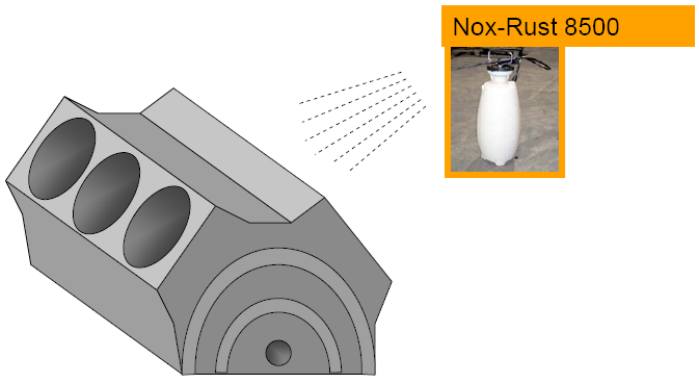
Product Notes:

Taking advantage of the stretch film's VCI and sealing it in with a proven water barrier protection, this combination is simple and clean. First wrap the metal with 4 wraps of Premium Metal-Guard Stretch Film, followed with overlapping layers of Versil-Pak. Versil-Pak comes in several styles. See details and see illustrations of application. The term of storage will be affected by the drying effect the environment has on the Versil-Pak.

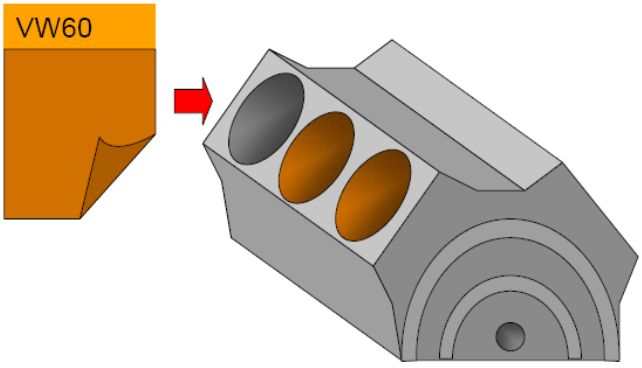


15 year Engine Preservation

Step 1 – Spray coat aluminum surfaces using Nox-Rust 8500

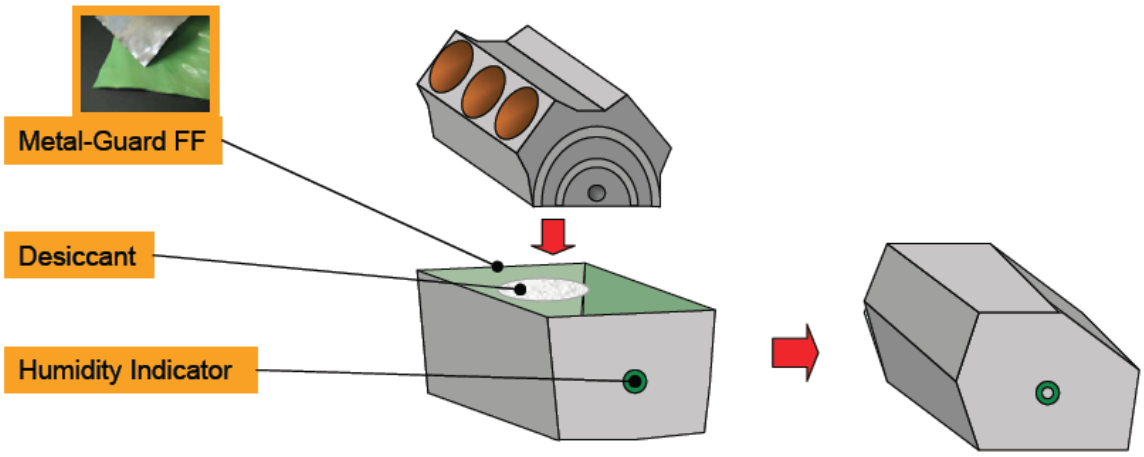


Step 2 – Place Nox-Rust VCI paper (VW60) sheet inside each cylinder



Step 3 – Package

a. Place engine inside Metal-Guard FF VCI laminated foil bag
b. Insert one (1) 16 unit desiccant
c. Install humidity indicator
d. Seal and vacuum close the bag

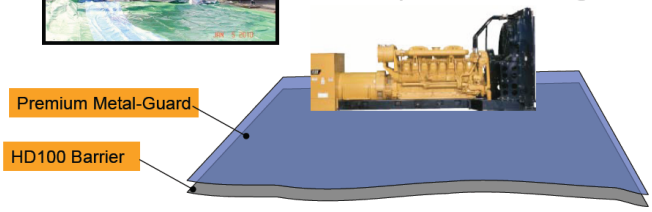


1+ year Heavy Equipment Outdoor Preservation

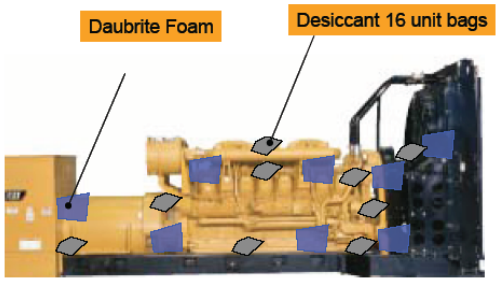
Step 1 – Prepare internal surfaces per Caterpillar Preservation Specification

Nox-Rust 1101 (VCI 10)

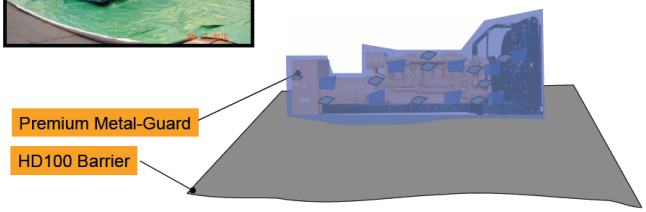
Step 2 – Lay out the sheeting materials and place genset (lift and operator supplied by customer) on the sheeting.



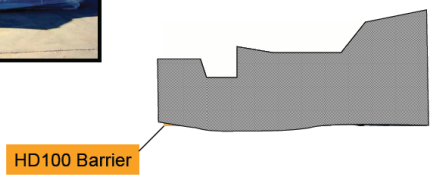
Step 3 – Place Daubrite Foam and Desiccants where critical surfaces are > 12" from the where the VCI poly will be wrapping the metal.



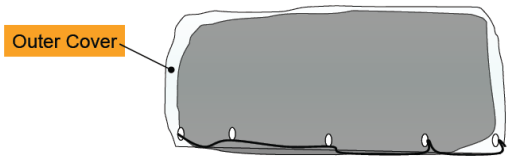
Step 4 – Enclose the unit with the Premium Metal-Guard by sealing and removing excess air.



Step 5 – Enclose the unit with the HD100 by sealing and removing excess air.



Step 6 – Outer cover tied down over and around and tied to itself.



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