Corrosion Protection for Flat-Rolled Steel Production

“Wrapper Queen”
As featured in the “Packaging World” Magazine.

CORTEC CORPORATION
Environmentally Safe VpCI®/MCI® Technologies
**Pickling of the Hot Rolled Coils and Disposition of Coils from the Pickle Line**

As the strip exits the acid tanks, it is rinsed with water to wash off any remaining acid. Frequently, however, traces of chloride or sulfate ions are left on the strip surface, often causing “speck” or pinpoint rust later in the processing. To reduce the incidences of “speck” rust, the use of Cortec® VpCI-609® Powder in the pickle line rinse water is recommended.

After exiting the pickle line rinse tanks, the strip is then wound into coils destined for either the cold finishing mill (tandem mill), or shipped as hot rolled and pickled. In either case, a surface and/or edge treatment of the coil with oil or water based VpCI® products is recommended.

These coils may be edge sealed or “cocooned” with a ready-to-use VpCI®-369D or VpCI®-389D (water-based version). For those coils going to further cold finishing operations, two choices are available. For those wanting an oil free steel, Cortec® VpCI®-347 or VpCI®-377 diluted with water are recommended as a full surface treatment. For those wishing oiled steel, use a full surface treatment of VpCI®-325 rust preventative oil.

**Cold Reduction of Hot Rolled Pickled Strip—Tandem Mill Rolling**

After being hot rolled and pickled, the steel strip is still too thick and too “soft” for use. Cold reduction takes place in the tandem mill.
Annealing

VPci® Fluids Protect In-Process

Galvanizing, aluminizing, tinning, black plate, and coil paint also need protection after processing. Cortec's proven oil or water based protection for surface and edge treatments are fully compatible to assure Total Corrosion Control.

Finishing Operations

Following cold reduction and annealing, the steel is subject to corrosion prior to further finishing operations. Edge treatment with Cortec® VPCI®-337 will protect coils in-process for subsequent operations.

Temper Rolling

To provide the cleanest strip possible, most material is wet rolled at the temper mill. For cold rolled steel, Cortec® VPCI®-344 diluted with water can be used as a wet tempering fluid.

For galvanized or aluminized steels, Cortec® VPCI®-347 diluted with water at a range of 2.5%-5% is recommended as a wet tempering fluid.

Environmentally Friendly ISO 14001 Certified
Traditional rust preventatives do not stop speckling on the internal coil surfaces but VpCI® protects. Humidity and condensed moisture easily penetrate the coil forming a highly corrosive environment inside the coil. Rust, speckling and staining can develop in minutes under these conditions. VpCI® Vapor phase Corrosion Inhibiting action emits wherever humidity and corrosive agents can penetrate to provide complete corrosion protection.

Cortec® VpCIs cut costs!
- Water-based VpCIs are more economical than conventional oil-based rust preventatives.
- Efficient application results in labor savings.
- Eliminates use of messy and toxic coatings.
- Minimizes packaging materials and costs.

VpCI® treatments virtually eliminate economic loss due to rust, speckling, staining, and other forms of corrosion. You can eliminate claims and returns while improving the quality of your product. As a result, your processing will become more streamlined leading to more efficient operations overall.

Cortec® VpCI® Packaging preserves quality!
Cortec® packaging technology preserves manufactured products like a tin can preserves tomatoes. Complete multimetal corrosion protection integrated in a wide variety of packaging products assures delivery of corrosion-free metal worthy of your reputation. Designed for specific applications and systems, these cost effective Cortec® packaging products also minimize handling damage, lower labor costs, reduce overall packaging costs and assure environmentally friendly results.

<table>
<thead>
<tr>
<th></th>
<th>Annual Economic Loss Due to Corrosion</th>
<th>Cost of VpCI® Treatment to Protect Total Production</th>
<th>Total Savings With Cortec® VpCI®</th>
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</thead>
<tbody>
<tr>
<td>Per Shift</td>
<td>$4,500</td>
<td>$100</td>
<td>$4,400</td>
</tr>
<tr>
<td>Per Day</td>
<td>$13,500</td>
<td>$300</td>
<td>$13,200</td>
</tr>
<tr>
<td>Per Week</td>
<td>$94,500</td>
<td>$2,100</td>
<td>$92,400</td>
</tr>
<tr>
<td>Per Month</td>
<td>$410,625</td>
<td>$9,125</td>
<td>$401,500</td>
</tr>
<tr>
<td>Per Year</td>
<td>$4,927,500</td>
<td>$109,500</td>
<td>$4,818,000</td>
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</table>

Figures are based on a steel mill producing and shipping 100 ten ton coils per shift, three shifts per day, seven days per week, a nominal material and manufacturing cost of $300 per ton, with a 1.5% economic loss due to corrosive attack.
Innovative Cortec® Corrosion Protection Solutions

Flat-rolled steel packaging remained virtually unchanged for 25 years until Cortec Corporation pioneered the development of Vapor phase Corrosion Inhibitor plastic films in 1982. This VpCI® technology complimented Cortec’s proven metal working fluids and other packaging products which ultimately led to Cortec’s Total Corrosion Control methodology protecting metal from ingot to finished product. Cortec® packaging materials and systems assure delivery of flat-rolled steel product at its destination in prime condition.

For In-Plant Transit and Storage

Cortec® VpCI® film products incorporate a patented VpCI® Vapor phase Corrosion Inhibiting technology which has become the most noteworthy advancement in metals packaging since reinforced steel wrap was first introduced in 1968. By infusing VpCI® chemistry as an integral part of the film, protective vapors are emitted which form a thin, mono-molecular and extremely effective protective barrier on the steel. This protective layer is self-replenishing providing continuous protection even in the presence of moisture vapor or condensation. No special cleaning is required prior to painting, plating, stamping, welding, forming etc.

Packaging Solutions

Cortec® VpCI® papers, paperboard, and flexible packaging substrates eliminate the need for a variety of materials to protect your metals. The cleanest neutral natural kraft prevents contamination and is simple to use. These fibre products are environmentally safe, fully recyclable, repulpable, bio-degradable, and non-toxic. They provide exceptional protection for dry or oiled metals during storage, transit, and export shipments.

Environmentally Friendly ISO 14001 Certified
CorTeC® Leads the Way Packaging Primary Coils.

Whether “thru the eye”, cocooned, or on skids, CorTeC® has been the leader paving the road to more efficient corrosion-free flat-rolled steel packaging.

BHP Steel, Australia
– Since 1991
Feasibility of the “thru-the-eye” stretch system made possible by Cor-Pak® VpCI® Stretch Film. This method originated in Australia and now coil wrapping stretch machines are common practice around the world running Cor-Pak® VpCI® Stretch Film.

Weirton Tin Mill, USA
– Since 1993
CorTeC® films reduced costs significantly by mechanizing wrapping system, which eliminated steel strapping, reduced labor costs, while preventing corrosion in transit.

Thomas Strip Mill, USA
– Since 1999
Utilizing the proven VpCI® stretch method to wrap stacks, CorTeC® packaging products made possible an innovative change lowering labor costs and minimizing use of packaging materials.

Total Corrosion Control • Total Corrosion Control®
# Buyer’s Guide for Corrosion Protection of Flat-Rolled Steel

## VpCI® Cleaning and Surface Protection Systems

<table>
<thead>
<tr>
<th>Product</th>
<th>Description</th>
<th>Sizes Available</th>
<th>Applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>VpCI®-325</td>
<td>Ready-to-use vegetable oil/solvent-based liquid for multi-metal corrosion protection. Provides excellent protection to high surface finishes, i.e., minimum spangle galvanized steels.</td>
<td>16 oz (473 mL) EcoSpray™ bottles (12 per carton), 5 gal (19 L) pails, 55 gal (208 L) drums, totes, and bulk.</td>
<td>Ready-to-use thin-film oil-based rust preventative for full surface application. Replaces conventional slushing oils.</td>
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<tr>
<td>VpCI®-422</td>
<td>Environmentally friendly biodegradable rust and stain remover for ferrous and non-ferrous metals. Contains 92% USDA Certified Biobased Content.</td>
<td>5 gallon (19 L) pails, 55 gallon (208 L) drums, totes, and bulk. Also available in EcoAir® 14 oz (413 mL) spray cans, 12 cans per carton.</td>
<td>Derusting of coils, sheets, machinery, and metal parts by dipping, brushing, and spraying. Replaces inorganic acids (i.e., phosphoric, sulfuric, etc.).</td>
</tr>
<tr>
<td>VpCI®-377</td>
<td>Water-based concentrate dry film rust preventative for indoor protection of equipment and components. Protects ferrous and yellow metals.</td>
<td>5 gallon (19 L) pails, 55 gallon (208 L) drums, totes, and bulk. Also available in EcoAir® 12 oz (353 mL) compressed air spray cans, 12 cans per carton.</td>
<td>Thin film coating for dry storage of castings, tubular parts, gears, structural steel, sintered metals, bar and roll stock.</td>
</tr>
<tr>
<td>VpCI®-338</td>
<td>Waterborne corrosion inhibitor based on Vapor phase Corrosion Inhibitor Technology. Particularly effective on ferrous metals, aluminum, and tin-plate. Made with FDA approved ingredients for steel and tin plate according to CFR Title 21, § 178.3300.</td>
<td>5 gallon (19 L) pails, 55 gallon (208 L) drums, totes, and bulk.</td>
<td>Excellent for edge treatment of aluminum, tin, and black plated coils and stacks.</td>
</tr>
<tr>
<td>VpCI®-344</td>
<td>Waterborne corrosion preventative coolant for use in wet tempering of galvanized or cold-rolled steel. Also can be used in light stamping operations where some lubrication is required. Vapor phase action for difficult to reach surfaces.</td>
<td>5 gallon (19 L) pails, 55 gallon (208 L) drums, totes, and bulk.</td>
<td>Wet tempering fluid for hot rolled, cold rolled, and galvanized steel.</td>
</tr>
<tr>
<td>VpCI®-347</td>
<td>Multifunctional corrosion inhibitor/heavy-duty lubricant concentrate for metalworking operations. Resistant to rancid attack by bacteria.</td>
<td>5 gallon (19 L) pails, 55 gallon (208 L) drums, totes, and bulk.</td>
<td>Full surface treatment to replace chromate conversion coating on galvanized steel. Ideal for heavy-duty cutting, milling, turning, drilling, boring, broaching, and other machining operations.</td>
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<tr>
<td>VpCI®-369/ VpCI®-369 D/ VpCI®-369 M</td>
<td>Oil-based barrier coating that provides extended outdoor multi-metal protection. Leaves a translucent, oily film that is scratch resistant and self healing. Product can be diluted with oil. Easily removed with common cleaners. Prediluted (D) version available. VpCI®-369 M qualified to MIL-PRF-16173E (Grade 2).</td>
<td>5 gallon (19 L) pails, 55 gallon (208 L) drums, totes, and bulk. Also available as CorShield® VpCI®-369 11 oz (312 g) aerosols, 6 per carton.</td>
<td>Edge treatment of oiled coils and stacks for export shipment and outdoor storage of hot rolled, cold rolled, galvanized, and aluminized steels. Lubrication/protection of gears and wire rope. Stamping’ drawing oil additive.</td>
</tr>
<tr>
<td>VpCI®-377</td>
<td>Water-based concentrate dry film rust preventative for indoor protection of equipment and components. Protects ferrous and yellow metals.</td>
<td>5 gallon (19 L) pails, 55 gallon (208 L) drums, totes, and bulk. Also available in EcoAir® 12 oz (353 mL) compressed air spray cans, 12 cans per carton.</td>
<td>Thin film coating for dry storage of castings, tubular parts, gears, structural steel, sintered metals, bar and roll stock.</td>
</tr>
<tr>
<td>EcoSpray™ Rust Blocker VpCI®-389</td>
<td>Water-based coating to rust-proof iron, steel, and other ferrous metals. An environmentally friendly replacement to oil-based products.</td>
<td>16 oz (473 mL) bottles, 12 per carton. Also available in 5 gallon (19 L) pails, 55 gallon (208 L) drums, totes, and bulk.</td>
<td>Indoor and outdoor corrosion protection for equipment and metal parts.</td>
</tr>
<tr>
<td>VpCI®-418/ VpCI®-418 L/ VpCI®-418 LM</td>
<td>Non-foaming heavy-duty alkaline cleaner and degreaser with flash rust protection. Liquid L (with silicates) and LM (without silicates) versions available.</td>
<td>VpCI®-418: 100 lb (45 kg) drums and bulk, VpCI®-418 L/LM: 5 gallon (19 L) pails, 55 gallon (208 L) drums, totes, and bulk.</td>
<td>Cleaning and degreasing of metal parts or hot rolled, cold rolled, and galvanized steel.</td>
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</tbody>
</table>

## MRO Products for Equipment and Infrastructure Corrosion Protection

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</tr>
</thead>
<tbody>
<tr>
<td>ConVerter® Rust Converter Primer</td>
<td>Fast-drying, water-based one-coat system that converts rusted surfaces to a hydrophobic passive layer and prevents further rusting through a unique formulation of chelating agents and PVC resins.</td>
<td>1 gallon (3.8 L) and 5 gallon (19 L) pails.</td>
<td>Rust converter for corroded structural steel, equipment, tanks, etc.</td>
</tr>
<tr>
<td>VpCI®-111 Emitter</td>
<td>Unique self-stick device slowly releases Vapor phase Corrosion Inhibitor vapors that form a protective molecular layer on metal surfaces in enclosed spaces.</td>
<td>2.25 in. diameter x 1.25 in. high (5.7 cm x 3.2 cm) cup with breathable membrane. One emitter protects 11 ft³ (312 L).</td>
<td>Corrosion protection of electrical and electronic equipment in steel mills.</td>
</tr>
<tr>
<td>VpCI®-329/ VpCI®-329 D</td>
<td>Oil-based rust preventative offers a tenacious film which clings to metal surfaces and releases Vapor phase Corrosion Inhibitors that adsorb onto the metal surface. VpCI®-329 D is ready-to-use version.</td>
<td>5 gallon (19 L) pails, 55 gallon (208 L) drums, totes, and bulk.</td>
<td>Edge spray for coils; fogging of metal compartments; dipping and storage of parts.</td>
</tr>
<tr>
<td>VpCI®-423</td>
<td>Environmentally friendly biodegradable rust and tarnish remover gel excellent for application to vertical surfaces and hard to reach areas. Contains 91% USDA Certified Biobased Content.</td>
<td>5 gallon (19 L) pails, 55 gallon (208 L) drums, totes, and bulk. Also available in EcoAir® 16 oz (473 mL) spray cans and EcoClean® 16 oz (473 mL) bottles, 12 per carton.</td>
<td>Derusting of coils, sheets, machinery, and metal parts by dipping, brushing, and spraying. Replaces inorganic acids (i.e., phosphoric, sulfuric, etc.). Good for vertical surfaces.</td>
</tr>
<tr>
<td>VpCI®-617</td>
<td>A water-based corrosion inhibitor/antiscalant water treatment to extend equipment life and improve heat transfer efficiency in steel and copper boiler and steam systems.</td>
<td>5 gallon (19 L) pails, 55 gallon (208 L) drums, totes, and bulk.</td>
<td>Corrosion/scale inhibitor for low to medium pressure boilers and steam systems during operation.</td>
</tr>
</tbody>
</table>
A unique concentrated liquid formulation that protects ferrous and non-ferrous metals from corrosion and prevents scale formation.

5 gallon (19 L) pails, 55 gallon (208 L) drums, totes, and bulk. Corrosion/scale inhibitor for fresh water and glycol closed loop cooling systems.

Complete corrosion protection system for repair of spalled and cracked concrete utilizing Cortec's Migrating Corrosion Inhibitor™ Technology

Corporation’s obligation under this warranty shall be limited to replacement of product that proves to be defective. To obtain replacement product under this warranty, the customer must notify Cortec Corporation of the claimed defect within six months after shipment of product to customer. All freight charges for replacement product shall be paid by customer.

Cortec Corporation shall have no liability for any injury, loss or damage arising out of the use of or the inability to use the products.

LIMITED WARRANTY

BEFORE USING, USER SHALL DETERMINE THE SUITABILITY OF THE PRODUCT FOR ITS INTENDED USE, AND USER ASSUMES ALL RISK AND LIABILITY WHATSOEVER IN CONNECTION THERE WITH. No representation or recommendation not contained herein shall have any force or effect unless in a written document signed by an officer of Cortec Corporation.

THE FOREGOING WARRANTY IS EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES, EXPRESS, IMPLIED OR STATUTORY, INCLUDING WITHOUT LIMITATION ANY IMPLIED WARRANTY OF MERCHANTABILITY OR OF FITNESS FOR A PARTICULAR PURPOSE. IN NO CASE SHALL CORTEC CORPORATION BE LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES.

Visit our website for more information on Cortec® Vapor phase Corrosion Inhibitors.

CortecVCI.com

TOTAL CORROSION CONTROL

Cortec® Corporation is dedicated to controlling corrosion at all stages of a product life cycle. Cortec® Corporation has developed a diverse range of corrosion protection products including cleaners, metalworking fluids, water and oil-based coatings and corrosion inhibitors, rust removers, paint strippers, emitters, powders, packaging foams, paper, films, surface treatments and admixtures for concrete as well as additives for water, oil & polymers. Contact Cortec® for additional brochures and information.

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