

# CORROSION PROTECTION FOR FLAT-ROLLED STEEL PRODUCTION



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



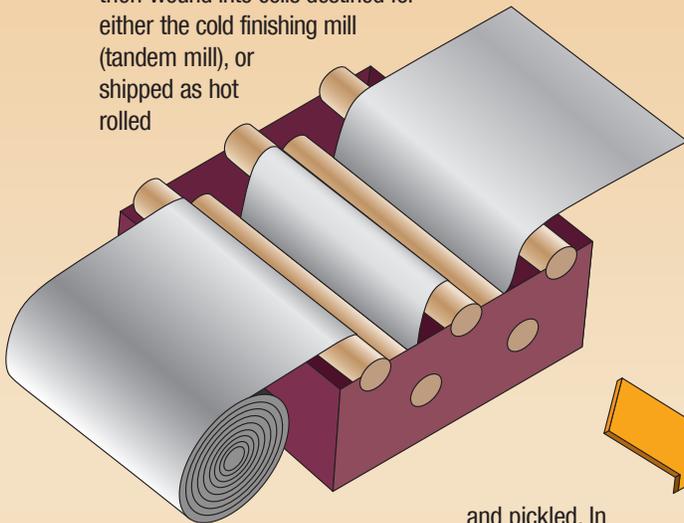
**CORTEC**  
CORPORATION

Environmentally Safe VpCl®/MCl® 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

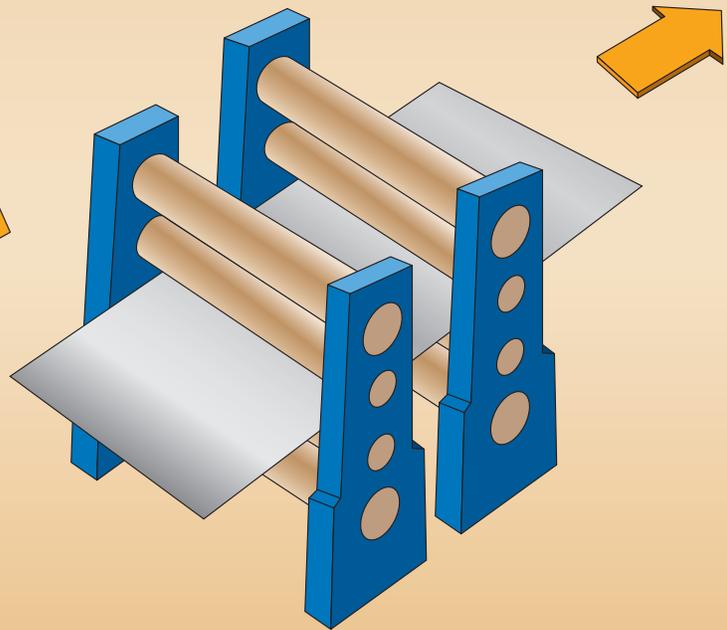


and pickled. In either case, a surface and/or edge treatment of the coil with oil or water based **VpCI®** products is recommended.

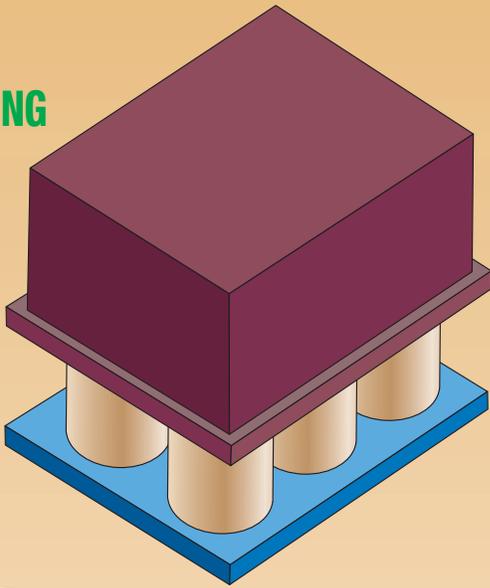
These coils may be edge sealed or "cocooned" with a ready-to-use **VpCI®-369D** or **VpCI®-389D** (water-based version). For those coils going to further cold finishing operations, two choices are available. For those wanting an oil free steel, **Cortec® VpCI®-347** or **VpCI®-377** diluted with water 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.

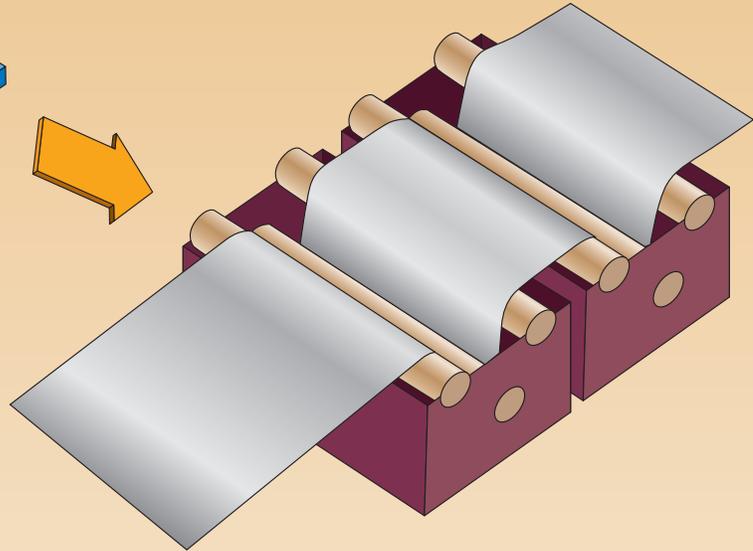


## ANNEALING



## 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.**



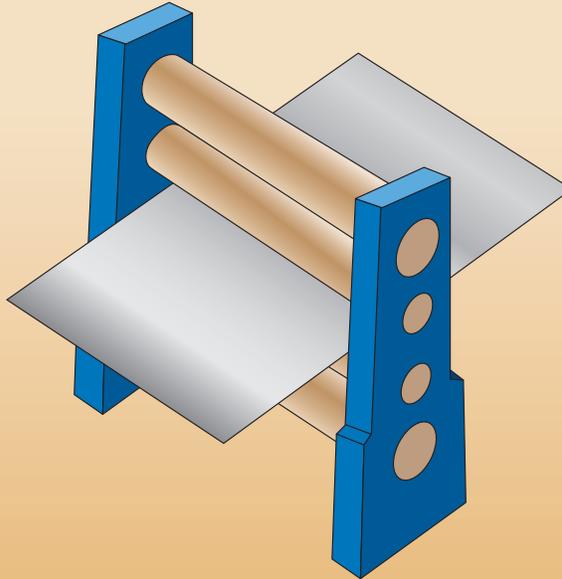
## FINISHING OPERATIONS

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**

**“If controlling and delivering corrosion free steel were simply choosing the right packaging materials, your work in the steel industry would be much less complex. Cortec® Corporation since 1977 has been committed to solving all corrosion problems. By exploring innovative technology at Cortec® Laboratories, we are fulfilling that vision every day with Total Corrosion Control .”**

**– Boris A. Miksic, President & CEO**

## STOP CORROSION NOT PRODUCTION!

Cortec's Total Corrosion Control keeps you running from start to finish. Producing quality flat rolled steel doesn't happen without all systems operating properly and consistently- don't let them fail by corrosion. Cortec® MCI®/VpCI® technologies protect concrete foundations, tanks, valves, motors, compressors, circuit boards, electrical boxes, bearings and everything you depend on to keep production rolling.



## 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.

## CORTEC® VpCI® PROTECTS!



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.

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

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.

**TOTAL CORROSION CONTROL™ • TOTAL CORROSION CONTROL™**

# 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® 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**

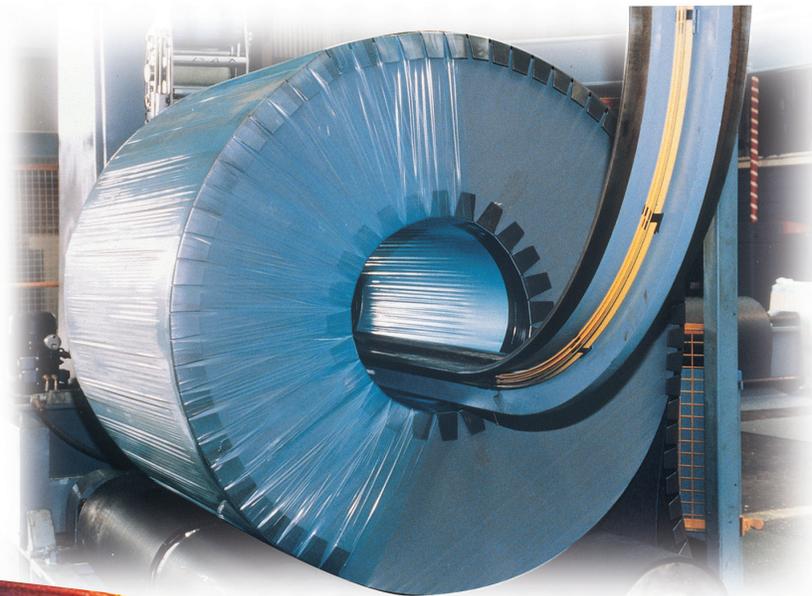
## CORTEC® LEADS THE WAY PACKAGING PRIMARY COILS.

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® VpCl® Stretch Film**. This method originated in Australia and now coil wrapping stretch machines are common practice around the world running **Cor-Pak® VpCl® 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 VpCl® 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			
Product	Description	Sizes Available	Applications
VpCI®-325	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.	16 oz (473 mL) EcoSpray™ bottles (12 per carton), 5 gal (19 L) pails, 55 gal (208 L) drums, totes, and bulk.	Ready-to-use thin-film oil-based rust preventative for full surface application. Replaces conventional slushing oils.
VpCI®-422	 Environmentally friendly biodegradable rust and stain remover for ferrous and non-ferrous metals. Contains 92% USDA Certified Biobased Content.	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.	Derusting of coils, sheets, machinery, and metal parts by dipping, brushing, and spraying. Replaces inorganic acids (i.e., phosphoric, sulfuric, etc.).
VpCI®-377	Water-based concentrate dry film rust preventative for indoor protection of equipment and components. Protects ferrous and yellow metals.	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.	Thin film coating for dry storage of castings, tubular parts, gears, structural steel, sintered metals, bar and roll stock.
VpCI®-338	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.	5 gallon (19 L) pails, 55 gallon (208 L) drums, totes, and bulk.	Excellent for edge treatment of aluminum, tin, and black plated coils and stacks.
VpCI®-344	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.	5 gallon (19 L) pails, 55 gallon (208 L) drums, totes, and bulk.	Wet tempering fluid for hot rolled, cold rolled, and galvanized steel.
VpCI®-347	Multifunctional corrosion inhibitor/heavy-duty lubricant concentrate for metalworking operations. Resistant to rancid attack by bacteria.	5 gallon (19 L) pails, 55 gallon (208 L) drums, totes, and bulk.	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.
VpCI®-369/ VpCI®-369 D/ VpCI®-369 M	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).	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.	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.
VpCI®-377	Water-based concentrate dry film rust preventative for indoor protection of equipment and components. Protects ferrous and yellow metals.	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.	Thin film coating for dry storage of castings, tubular parts, gears, structural steel, sintered metals, bar and roll stock.
EcoSpray™ Rust Blocker VpCI®-389	Water-based coating to rust-proof iron, steel, and other ferrous metals. An environmentally friendly replacement to oil-based products.	16 oz (473 mL) bottles, 12 per carton. Also available in 5 gallon (19 L) pails, 55 gallon (208 L) drums, totes, and bulk.	Indoor and outdoor corrosion protection for equipment and metal parts.
VpCI®-418/ VpCI®-418 L/ VpCI®-418 LM	Non-foaming heavy-duty alkaline cleaner and degreaser with flash rust protection. Liquid L (with silicates) and LM (without silicates) versions available.	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.	Cleaning and degreasing of metal parts or hot rolled, cold rolled, and galvanized steels.

MRO Products for Equipment and Infrastructure Corrosion Protection			
Product	Description	Sizes Available	Applications
CorrVerter® Rust Converter Primer	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.	1 gallon (3.8 L) and 5 gallon (19 L) pails.	Rust converter for corroded structural steel, equipment, tanks, etc.
VpCI®-111 Emitter	Unique self-stick device slowly releases Vapor phase Corrosion Inhibitor vapors that form a protective molecular layer on metal surfaces in enclosed spaces.	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).	Corrosion protection of electrical and electronic equipment in steel mills.
VpCI®-329/ VpCI®-329 D	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.	5 gallon (19 L) pails, 55 gallon (208 L) drums, totes, and bulk.	Edge spray for coils; fogging of metal compartments; dipping and storage of parts.
VpCI®-423	 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.	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.	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.
VpCI®-617	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.	5 gallon (19 L) pails, 55 gallon (208 L) drums, totes, and bulk.	Corrosion/scale inhibitor for low to medium pressure boilers and steam systems during operation.

VpCl®-649	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.
MCI® HPRS	Complete corrosion protection system for repair of spalled and cracked concrete utilizing Cortec's Migrating Corrosion Inhibitor™ Technology	Contact Cortec® for details.	Repair and restoration of reinforced concrete and masonry structures in steel mills.

VpCl® Packaging Products			
Product	Description	Sizes Available	Applications
Cor-Pak® EX VpCl® Film	High density polyethylene film extruded with Vapor phase Corrosion Inhibitors. Protects ferrous and non-ferrous metals. Excellent barrier. Recyclable.	1.0-1.25 mil (25-35 microns).	Used for interleaving cut sheets and slit coils, and for wrapping/shrouding other palletized applications.
VpCl®-126	Translucent plastic films containing Vapor phase Corrosion Inhibitors for multi-metal protection. Heat sealable. Also available in zip-lock bags and shrink film. Recyclable.	Available in thicknesses of 1.5-10 mils (30-250 microns), widths of 3 in to 30 ft (7.6 cm-9.1 m).	Customizable corrosion inhibiting PE film for use as bags, sheeting, and tubing for specific needs.
EcoWeave®	Woven polypropylene sheeting that offers extra strength, durability, corrosion protection, and reusability. Recyclable.	Standard and custom sizes. Contact Cortec® customer service for more info.	Export packaging of equipment, steel sheeting and flat stock, steel coils, pallets, heavy metal parts. Can be custom sewn for exact fit.
Eco-Corr Film®	Biodegradable corrosion inhibiting film for vapor phase corrosion protection of ferrous and non-ferrous metals. Formulations contain up to 40% biobased content. Passes tests for disintegration and biodegradation in an aerobic composting environment per ASTM D6400-12.	Custom order product: 36 in (91.4 cm) and 48 in (122 cm) rolls and a wide variety of custom sizes and forms.	Storage and shipment of metal parts where biodegradable film is required.
CorShield® Fabric	A multiple-layered protective fabric with a non-woven, soft inside layer. Protects valuable items from corrosion and mechanical damage. Recyclable.	Custom sizes up to 6.7 ft (20.5 m) wide.	Excellent for coil wrapping and palleting.
CorShield® VpCl®-146 Paper	VpCl® Kraft paper protects ferrous and non-ferrous metals against aggressive environments such as humidity, SO <sub>2</sub> , H <sub>2</sub> S, and galvanic corrosion of dissimilar metals. Fully recyclable/repulpable.	Roll stock 48 in x 200 yd (1.22 m x 183 m), 36 in x 200 yd (0.91 m x 183 m), 48 in x 200 yd (1.22 m x 183 m), and sheeting perfed on the roll 12 in x 12 in (0.31 m x 0.31 m). Custom sizes also available.	Used for interleaving and parts wrapping.
Cor-Pak® VpCl® Stretch Film	Corrosion inhibiting transparent stretch film holds protected parts securely in place. Does not leave residue. Puncture resistant. Recyclable.	Available in standard machine film sizes and gauges.	Stretch wrap used for coil wrapping, slit coil wrapping, sheets, etc.
Cor-Pak® Liner-board	VpCl®-treated linerboard used as the inner liner of corrugated products. Fully recyclable.	Custom sizes and constructions available in 42 lb/1,000 ft <sup>2</sup> (205 g/m <sup>2</sup> ) linerboard.	Packaging of single-use packs of spare parts and small items such as bearings, tools, and bolts.
Cor-Pak® VpCl® Corrugated PE Sheeting	Reusable corrugated high-density polyethylene corrosion protection sheeting with cushioning characteristics and PE strength. Fully recyclable.	Custom sizes—minimum 16 x 16 in (40.6 x 40.6 cm).	Packaging of metal parts, with cushioning and puncture resistance.

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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