



TECHNICAL RESOURCE

ARMOR VCI USAGE GUIDELINES

ARMOR PROTECTIVE PACKAGING® PRODUCT USAGE GUIDELINES

Armor Protective Packaging® provides the industry's cleanest, safest and easiest rust prevention and rust removal products for metal parts. ARMOR's full line of VCI (vapor corrosion inhibitor) packaging products, desiccants and its rust removal solutions are designed to protect ferrous and non-ferrous metals before, during and after transport or storage.

Armor Protective Packaging® VCI products are used to cover or wrap metal parts or surfaces. The continuous vaporization of this chemically treated packaging creates a safe, protective environment that effectively blocks out rust, corrosion and oxidation. It eliminates the need for messy greases, oils, and surface preparation. Parts are ready to use when removed from packaging.

ARMOR RUST PREVENTION AND REMOVAL PRODUCTS

ARMOR WRAP® VCI Papers

- ARMOR WRAP® VCI papers are neutral pH, natural Kraft paper, impregnated with VCI on both sides. VCI paper sheets are recommended to protect parts during in-process and packaging and are ideal for interleaving within packaging or placing on top of pallets. The paper absorbs moisture making it ideal for high humidity, high temperature areas and works faster to emit VCI than poly film due to its porosity. This allows the rust-preventing VCI to reach the metal part quicker to form its protective barrier.

ARMOR POLY® VCI Films

- ARMOR POLY® VCI films offer the combined benefit of barrier and rust prevention in a simple to use form. Used for lining bins/containers, individual bagging, large sheeting for shrouding, ARMOR POLY® films can be heat shrinkable, and produced to meet custom requirements (elastic, zip closures, tubing, auto bags, etc.).

ARMOR SHIELD® Products

- ARMOR SHIELD® VCI emitters come in various forms from foam pads to emitting devices to prevent corrosion in electrical boxes, export containers or anywhere where packaging is not feasible.
- ARMOR SHIELD® desiccants are drying agents used to reduce the humidity inside a closed container for a period of time during export shipments or long-term storage and will ensure optimum protection when used with VCI packaging.

ARMOR Liquids/Solutions

- Metal Rescue® Rust Remover BATH is a clean, safe, and easy liquid rust remover. Metal Rescue® BATH is water-based, non-hazardous, bio-degradable after use and requires no scrubbing or brushing. Metal Rescue® BATH simplifies rust removal in an industrial setting by eliminating the need for manual methods or toxic products such as strong alkali, acids or electrolysis.
- Metal Rescue® Rust Remover GEL is a cleaner, safer, and easier gel rust remover. Metal Rescue® GEL is non-hazardous, environmentally-friendly, and contains no harmful or corrosive acids, alkalis or solvents. Metal Rescue® GEL is formulated to cling to metal, making it ideal for use on vertical surfaces, spot rust, or rust in hard-to-reach areas.
- Dry Coat™ Rust Preventative is a water-based liquid RP for ferrous metals. It does not attract dirt or dust on metal parts such as other sticky or tacky products. It is eco-friendly and non-hazardous. Dry Coat™ RP is safe to use on ferrous metals, stainless steel and will not harm most elastomers or plastics.



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SHELF LIFE

ARMOR guarantees the amount of VCI that is impregnated into its packaging for **two years** from the date of manufacture, provided it is kept in its original packaging and stored inside and away from the elements.

LENGTH OF PROTECTION

Typically, ARMOR VCI packaging will protect parts for **approximately three years** of corrosion-free storage when used properly in normal warehouse conditions. However, successful long-term storage requires that all of the guidelines found under long-term storage be met. By following these guidelines, it is possible to lengthen this time-frame considerably. The key element in protecting parts for long-term storage is that the part must be completely clean, prior to wrapping in ARMOR products. We recommend that parts be completely wrapped or enclosed in airtight packaging for best results and longest protection time.

ARMOR cannot control variable conditions such as temperature and humidity extremes, airflow, production and process methods, surface conditions of metal to be protected, customer employee training and other factors beyond our control, therefore it is impossible to guarantee a specific length of protection. Additionally, if warehouse conditions are expected to be severe (i.e. over 90°F and 75% RH) for any length of time, other methods of rust preventatives such as Dry Coat™ RP or desiccants, may be needed, in conjunction with VCI packaging.

Note: While Shelf Life and Length of Protection are two separate characteristics of VCI packaging materials, they are somewhat interrelated. Shelf Life refers to how long the unused VCI packaging material can be stored prior to use. Length of Protection refers to how long the VCI packaging materials provide protection once in use. In both cases the duration depends on the product's storage conditions.

LONG-TERM STORAGE

For typical storage requirements and for periods up to three years, using the combination of ARMOR WRAP® paper and an ARMOR POLY® 4 mil mono bag **OR** an ARMOR DEFENDER™ 4 mil EQ bag is recommended. For long-term storage requirements in excess of three years, additional guidelines and product combinations should be used. It is important to test parts and packaging as extensively as possible prior to implementing any long-term storage projects and to seal or zip tie for airtight closure. For longer-term or more difficult storage please refer below:

Mid-Term Storage (3-8 Years)

- Wrap with ARMOR WRAP® paper (use Dry Coat™ Rust Preventative if wrapping is not possible)
- ARMOR DEFENDER™ 6 mil EQ bag (use ARMOR POLY® 6 mil mono bag if DEFENDER™ is unavailable)
- Desiccant (determined by package volume)
- ARMOR humidity indicators

Long-Term Storage (8-15 Years)

- Wrap with ARMOR WRAP® paper (use Dry Coat™ Rust Preventative if wrapping is not possible)
- ARMOR CRUSADER™ 6 mil EQ bag (use ARMOR POLY® 8 mil mono bag if CRUSADER™ is unavailable)
- Desiccant (determined by package volume)
- Emitters or emitter/desiccant combination (ARMOR SMARTY PAK™) for larger packs or packs with high metal surface area
- ARMOR humidity indicators



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GUIDELINES FOR SUCCESSFUL LONG-TERM STORAGE

Successful long-term storage requires that all of these guidelines be met:

- It is necessary to wear gloves when coming in contact with metal as fingerprints (which contain human oils and possibly contaminants) can cause a chemical reaction to the metal prior to wrapping in ARMOR packaging. Make sure that gloves are clean and as they become dirty or contaminated, replace them with a new supply.
- Be sure your parts are free of fingerprints, machining oils and acid or alkali residue. Neutral oils or a light rust inhibitor may be left on metal surfaces but may require laboratory testing to make sure there is compatibility between the VCI packaging and the oils. Regularly test coolants, RP liquids and/or other liquids used within the manufacturing process for concentration levels, pH, and to ensure they are fully titrated.
- Parts should be dry, clean and free from corrosion before packaging. Clean your product, preferably with a petroleum solvent or solvent emulsion cleaner. ARMOR VCI packaging will help prevent corrosion; however, it will not remove corrosion that has already occurred. To remove rust, ARMOR offers Metal Rescue® Rust Remover BATH and GEL.
- Package clean parts immediately after processing, manufacturing or cleaning.
- When using an ARMOR POLY® VCI bag, make sure it is not ripped or torn to ensure that VCI vapors are contained inside the package.
- Place metal part or multiple metal parts inside the appropriate thickness ARMOR POLY® VCI bag and seal tightly. Closure methods are zip tie, cable tie, knot, or heat seal for airtight storage. If the packaging is not contained, a protective concentration of VCI may never be reached.
- Wrap metal part fully when using ARMOR WRAP® VCI paper, ensuring the entire surface area is fully covered and secured. Place nothing between the metal surface to be protected and the VCI paper.
- Store packaged parts in an area where the temperature and relative humidity are the most consistent possible. Do not store parts outside.
- While the parts are sitting in bins waiting to be repackaged or further processed, the VCI bag should be closed/folded over to protect parts from exposure to liquids, water, and moisture. A sheet of VCI paper can also be used by placing it on top, covering parts. Make sure that associates are using clean, dry gloves while packing parts.
- Pine, oak and corrugated are very acidic and can contribute greatly to corrosion issues. Avoid contact of metal with woods by placing ARMOR WRAP® or ARMOR POLY® between these materials.
- Provide frequent training to employees who are responsible for packaging or processing metal parts on the proper storage and application of VCI products to ensure maximum effectiveness.

STORAGE OF ARMOR VCI PRODUCTS

For best results, do not leave ARMOR VCI packaging out in an open environment, either indoors or outdoors. Keep it in its original packaging or enclosed inside a container to ensure that the vapors remain in the packaging. As temperature and humidity levels increase, the rate of the volatilization of the chemicals contained in the packaging also increases, reducing the effectiveness and longevity of the product. We recommend contacting an ARMOR representative for input and guidance on your VCI packaging storage methods.



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STORAGE OF ARMOR VCI PRODUCTS CONT.

ARMOR WRAP® VCI Papers

- ARMOR WRAP® VCI papers are hygroscopic (absorbs moisture from the environment) so it is important to store in original packaging or enclosed inside a container. After VCI paper has been exposed to the atmosphere for a period of 24 hours, please remove the outside layer of paper from a roll, or the top four sheets from a stack of cut sheets and dispose of prior to using the rest of the product. Product should be stored in an environment that prevents material from getting damp or wet and at temperatures of 40° – 110°F (5° – 43°C).

ARMOR POLY® VCI Films

- ARMOR POLY® VCI films should be stored in an environment that prevents material from getting wet and at temperatures of 40° – 110°F (5° – 43°C).
- ARMOR VCI resins are hygroscopic (absorbs moisture from the environment) so it is important to store in original packaging. The bag in the container should always be tied shut when not in use. If the VCI resin absorbs significant levels of moisture, problems will arise during the extrusion or molding process. Product should be stored in an environment that prevents material from getting wet or damp and at temperatures of 40° – 110°F (5° – 43°C).

ARMOR SHIELD® Products

- ARMOR SHIELD® VCI emitters must be stored in original packaging. Once removed the VCI chemicals will begin to volatilize into the atmosphere. If allowed to sit in the open for a long period of time prior to use, the emitter will have diminished corrosion inhibiting performance. Product should be stored in an environment that prevents material from getting wet or damp and at temperatures of 40° – 110°F (5° – 43°C).
- ARMOR SHIELD® desiccants are hygroscopic (absorbs moisture from the environment) so it is important to store in original packaging with the lid or poly bag kept tightly closed at all times. If the desiccant pack absorbs significant levels of moisture it will not perform as designed. Product should be stored in an environment that prevents material from getting wet or damp and at temperatures of 40° – 110°F (5° – 43°C).

ARMOR Liquids/Solutions

- Metal Rescue® Rust Removers & Dry Coat™ Rust Preventative should be kept in original packaging or equivalent during storage. Keep containers closed and store away from heat sources. Small amounts of pressure may build up in container over time during storage; periodically release pressure to avoid bowing of container. After six months of storage agitation may be required to assure a uniform blend of all components. Store indoors at moderate temperatures 40° – 95°F (5° – 35°C).

REUSABILITY

ARMOR VCI products are not recommended for re-use for three primary reasons:

1. The rate at which VCI chemical volatilizes out of the product into the surrounding environment when exposed and in use
2. The inability to properly track and monitor the amount of time the materials have been exposed to the environment
3. Potential contaminants on the packaging that can be transferred

For those instances when re-use is necessary, be sure the packaging is free of dirt, holes, or other contaminants. Once these factors appear, it is best to use new, clean ARMOR VCI packaging. It is also important to note that the length of time the packaging material has been exposed to the environment (especially high heat/humidity) will greatly impact the effectiveness of the product. Do not re-use VCI packaging more than two times. Please note, ARMOR cannot guarantee the amount of VCI that remains in the packaging or substrate upon re-use.