Corrosion and factors affecting it

Corrosion is defined as gradual destruction of materials by reaction with their environment. Acids, corrosive environments, atmosphere and moisture play a vital role in corrosion.
Moisture plays a vital role in the corrosion process. Each atmosphere contains a certain amount of moisture and due to high temperature fluctuations between night and day, moisture accumulates in the form of dew on the equipment. It accelerates the corrosion of metals and electrical connections, reduces the electrical resistance of insulators and wires, eliminates the cleanliness and smoothness of the metal surface, and so on.

Atmospheric Corrosion

The Earth's atmosphere is a mixture of gases with relatively constant compounds (roughly 20% oxygen, 80% nitrogen and trace amounts of other gases). The most common air pollutants are sulfur dioxide, sulfur sulfide, hydrogen sulfide, chlorine, ammonia, nitrogen oxides, ash and soot, which contribute to the corrosion of ferrous and non-ferrous metals.

Gas	Pollution source
SO_2	Combustion of fossil fuels (mostly from powerplants)
H_2S	Wastewater treatment and chemical complexes
CO	Motor vehicle exhaust, incomplete combustion
NO, NO_2	General combustion process (mostly in motor vehicles)
CO_2	Combustion
HCL, CL_2	Combustion

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Corrosion Control and Equipment Maintenance:

Avoid increasing costs from:

Direct financial losses

Indirect financial losses

Temporary Corrosion Preventives:

Contact inhibitors

Oil, grease and greaseproof paper

Dry air or neutral gases like nitrogen

Moisture absorbers (silica gel)

Vapor Corrosion Inhibitors (VCI, or vapor phase inhibitors

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Permanent Corrosion Preventives:

paint

coating

Atmospheric Corrosion Preventives:

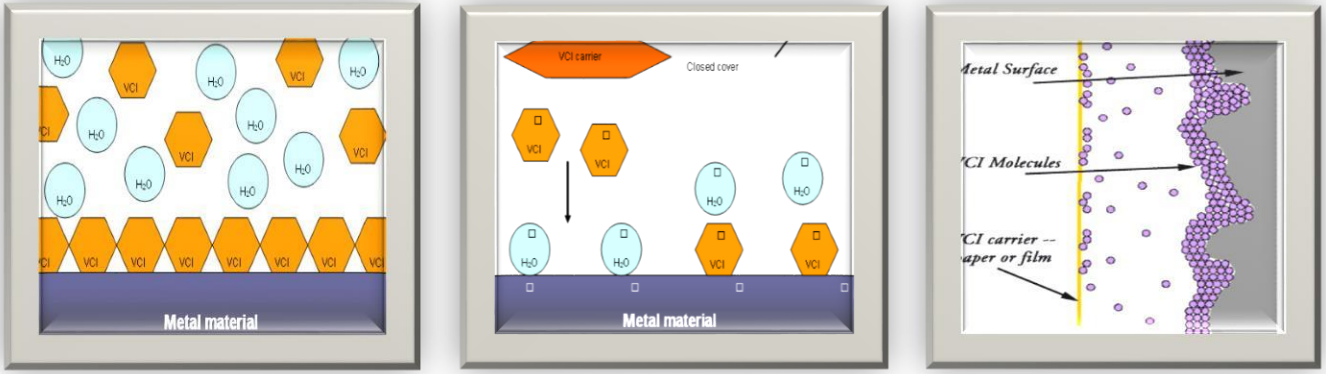
Temporary

Permanent

Vapor Phase Inhibitors (VCI)

In this method, highly volatile materials with a high vapor pressure at ambient temperature are used. These materials easily reach inaccessible seams and cracks in the metal, hit the metal surface and form a protective film.

These volatile compounds propagate in an enclosed space until equilibrium is reached.



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VCI mechanism of action

- SMP- VCI technology
- Speedy moisture passivation

VCI function:

- Evaporating and deactivating moisture
- Forming a thin film on metal surface
- Changing Ph
- Electric current passivation

- و

Benefits of VCI products

- No further degreasing, derusting, acid washing and cleaning or preparation are required prior to installation and use.
- VCI-protected pieces, parts and tools are always immediately ready for use.
- They provide corrosion protection for microelectronic devices to large equipment.
- They are less expensive and more accurate than other corrosion protection methods.
- There is no need for roofed warehouses (to protect materials from sunlight and weather).
- Speed of application compared to other corrosion protection methods
- Speed of operation of the equipment compared to methods such as degreasing the equipment.

Assorted Products:

MKC-BLUE VCI Fil

Details	Plastic film made of polyethylene, which includes vapor phase inhibitors.
Protection of a variety of metals	This is the best protector for equipment containing a combination of ferrous (steel, iron and alloys) and non-ferrous metals (aluminum, copper, brass, bronze and galvanized metal).
Length of protection	2-5 years
MKC-Blue film storage before use	Keep away from direct sunlight and moisture, at a temperature below 85 °F (30 °C).

Properties		MKC-Blue Film	Test method based on ASTM standard
Thickness of the film	-	150µ	D-6988
Falling dart impact resistance	-	367 gr	D-1709
Rupture strength	MD	0.65 lb-f (2.9 N)	D-1938
	TD	0.7 lb-f (3.1 N)	
Tensile strength at yield point	MD	1895 psi (13.1 Mpa)	D-882
	TD	1485 psi (10.2 Mpa)	
Tensile strength at break point	MD	3020 psi (20.8 Mpa)	D-882
	TD	2895 psi (19.96 Mpa)	
Elongation at break point	MD	400%	D-882
	TD	505%	
Vapor inhibitor ability (VIA)	-	Grade 2 and 3	NACE TM0208

MKC-Blue VCI Multimetal	Roll	Roll mouth limit (dimension)	Weight of each roll	sunlight resistance
	✓	30-120 cm	40 kg	Upon request

MKC-Blue VCI Multimetal	bags	dimension limits	sunlight resistance
	gusset	50×50×50	Upon request

Gusset and gusset-free bags

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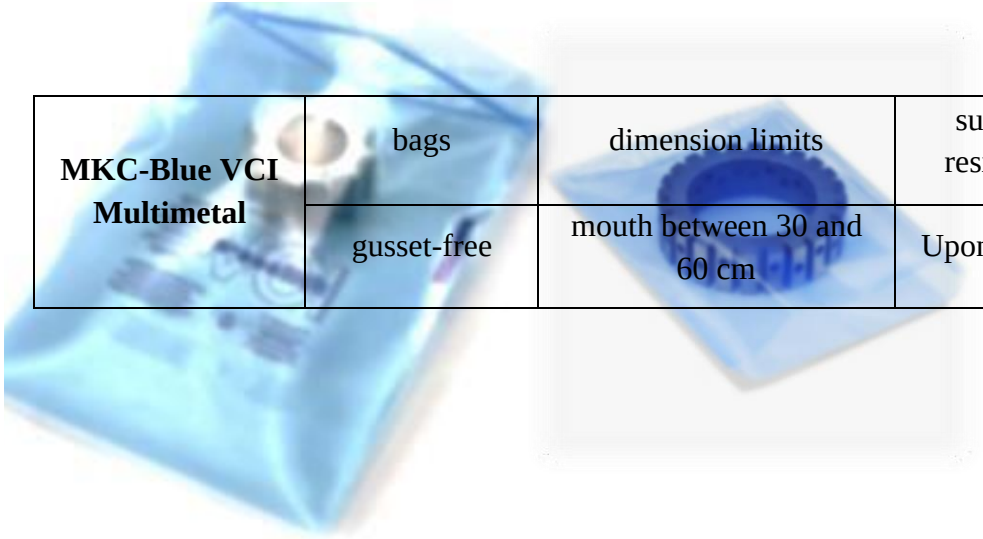

MKC-Blue VCI Multimetal	bags	dimension limits	sunlight resistance
	gusset-free	mouth between 30 and 60 cm	Upon request

Packaging tools

MKC-BLUE VCI Film

Details	Plastic films contain vapor phase inhibitors that shrink when heated.
Product Appearance	Standard white color based on the corrosion-resistance composition. The product is available in more colors on request.
Protection of a variety of metals	This is the best protector for equipment containing a combination of ferrous (steel, iron and alloys) and non-ferrous metals (aluminum, copper, brass, bronze and galvanized metal).
Length of protection	If the products are properly packaged and stored indoors and outdoors, this product will protect them against corrosion for 2 to 5 years.
MKC-Shrink storage before use	Keep away from direct sunlight and moisture, at a temperature below 85 °F (30 °C).

Properties		MKC-Blue Film	Test method based on ASTM standard
Thickness of the film	-	150µ	D-6988
Falling dart impact resistance	-	367 gr	D-1709
Rupture strength	MD	0.65 lb-f (2.9 N)	D-1938
	TD	0.7 lb-f (3.1 N)	
Tensile strength at yield point	MD	1895 psi (13.1 Mpa)	D-882
	TD	1485 psi (10.2 Mpa)	
Tensile strength at break point	MD	3020 psi (20.8 Mpa)	D-882
	TD	2895 psi (19.96 Mpa)	
Elongation at break point	MD	400%	D-882
	TD	505%	
Vapor inhibitor ability (VIA)	-	Grade 2 and 3	NACE TM0208

MKC-Shrink VCI	Roll	Roll mouth limit (dimension)	Thickness	Weight of each roll	sunlight resistance
		100-1000 cm	100-250 µ	40 kg	✓

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Note:

If the intensity of sunlight and heat is very high in the area, a layer with more anti-UV material should be used and make sure to consult with the manufacturer.

Packaging tools:

	methane cylinder	Fuel to generate heat
	Flame and heat diffuser (short handle)	shrinkage in VCI film
	Flame and heat diffuser (long handle)	shrinkage in VCI film

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	Automatic belt tensioner	To restrain the film and fasten the polyester belt
	Belt (polyester)	To restrain the film when packaging the equipment
	clamp	to connect the belts and restrain the film

	Zipper door	to enter and exit the packaged system for periodical visits of packaged equipment
	Shrinkable polyethylene adhesives	If a part of the film is perforated during heating, this adhesive sticks to the perforated part and fixes the hole by heating.
	Heat resistant gloves	In order to adhere the margins of the films together with heat, it is necessary to hit the heated film with slow strokes. So, it is necessary to use these gloves.

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MKC-Woven VCI film

Details	Plastic films made of polyethylene, containing vapor phase inhibitors
Protection of a variety of metals	This is the best protector for equipment containing a combination of ferrous (steel, iron and alloys) and non-ferrous metals (aluminum, copper, brass, bronze and galvanized metal).
Length of protection	2-3 years
MKC-Woven film storage before use	Keep away from direct sunlight and moisture, at a temperature below 85 °F (30 °C).

MKC-Woven Vci	Roll	Roll width limit	weight per square meter	Weight of each roll	sunlight resistance
		50-300 cm	180-200 gr	40 kg	✓

NACE TM0208-2018 standard	Grade 2 and 3
TL8135-002 standard	Grade 3

Note: This product is solely used for packing steel coils.

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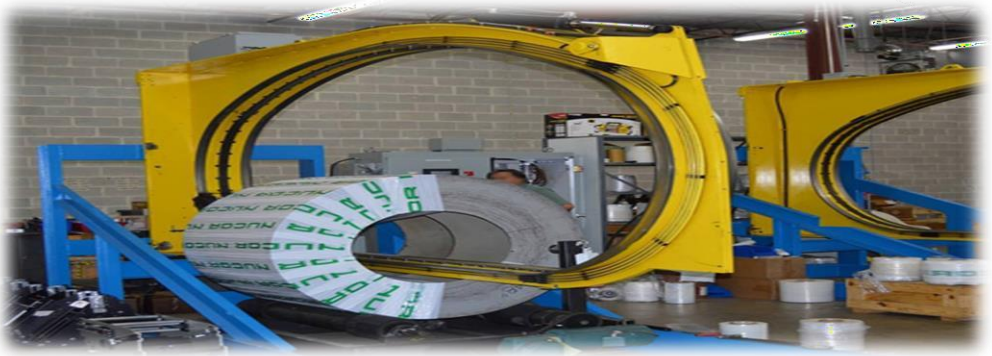
MKC-Stretch wrap VCI film

Details	Plastic films made of polyethylene, containing vapor phase inhibitors
Protection of a variety of metals	This is the best protector for equipment containing a combination of ferrous (steel, iron and alloys) and non-ferrous metals (aluminum, copper, brass, bronze and galvanized metal).
Length of protection	2-3 years
MKC-Stretch film storage before use	Keep away from direct sunlight and moisture, at a temperature below 85 °F (30 °C).

	Roll	Roll width limit	Thickness	Weight of each roll	sunlight resistance
MKC-Stretch Vci	**Double-sided tape**	15-30 cm	Minimum 80µ	5 kg	✓
	single-sided tape				



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MKC-Foil VCI film

Details	A composite of polyethylene film in three layers and aluminum foil and one layer of polyester
Protection of a variety of metals	This is the best protector for equipment containing a combination of ferrous (steel, iron and alloys) and non-ferrous metals (aluminum, copper, brass, bronze and galvanized metal).
Length of protection	30 years
MKC-Stretch film storage before use	Keep away from direct sunlight and moisture, at a temperature below 85 °F (30 °C).

MKC-Foil VCI	bag	bag width limit	Thickness	sunlight resistance
		58 cm	150-220µ	✓

Note: Mainly used for packing caliber and rocket ammunition.

Film Type	mm ccn ess (mic ron)	O xyg en Transm isslon cclm2/za nours (100% exygen) 2S°C 45% Rel at ive Hum idity	vVator vapour g/m:z/:z4 naurs 38”C 90 % RH
Myl ar Polyeste r	1 2	1 40	40
Metallls ed Myl ar OD 3)	1 2	0.5	<1
PVdC coa tea polyester	1 ii	6	14
Plain ce llulose	22	8-130 dependant an moisture	3,500
NC coated cellulose	3 0	10	12
PVdC coa ted cellul ose	28	8	5
L D P E	eS	8.000	1 8
I-J DC E	25	3, 000	9
Propafilm C28	28	10	5
P ropaiilm in c	20	2.200	7
P ropafoil (metallised)	25	1 OO	1.5
Cast PP	25	4,2OO	12
Cast nylon	5O	140+ dependant an moisture	35
	30	80+ dependant an moisture	1 80
Orienteo nylon 6	15	46 dependant an moisture	260
EVAL F	20	0.2 dependant on moisture	75
EVAL E	20	1.8 dependant	2 9
F'lasticised P'v'C	20	2,OoO+ dependant on moisture	200 +
Rig id F'VC	20	26O	6 O
Extruded P'VdC	20	3	5
Orienteo polystyren e	25	2,500+	1 TO
/ Jitril e b arTier res in	20	16	1 20
AIuminiumYoil	9	0+ dependant an pinhales	O +

NEW TECH FILM

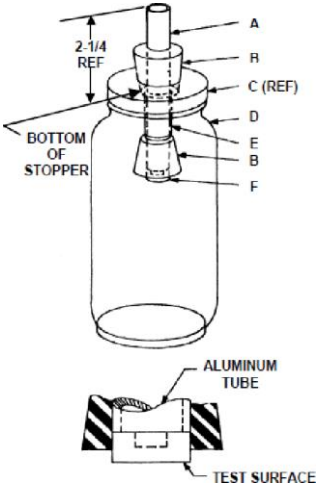
VCI foil – protection

VCI foil – protection

Tests:

NACE TM0208-2018 standard

MIL-STD-3010



A - Aluminum lube — 4-1/2 in lenpln, 5/8 OD and 1/2 ID The tube shall nave a capacity of 1s ml of distilled

B - RuLDe stop er"- #6-1/2 rubl›er opp t w : .:. r r dl.

C - Jar lio — See Figure 5 ror details.
D - Jar — Quan size, mould size 2-3/8 ,D meter, 7 incnes in eDht, 1/4

n ev.

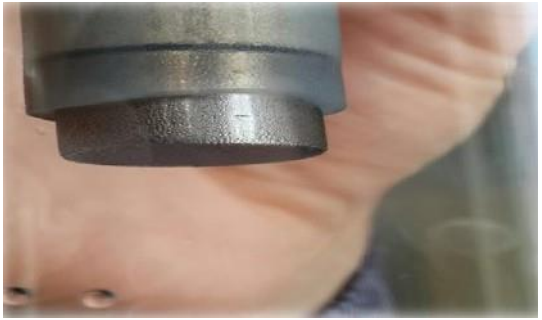
F - Tesng t« D. 1/2 long'

Mth 3/B oeep fat bottDm hole

NOTES.

Dimensions in inches
2. All pans of the specimen holoer assembly sñaii De in contan with adjacent oan

B s N
NDR* "DsSE BLY



Grade 0

Controls

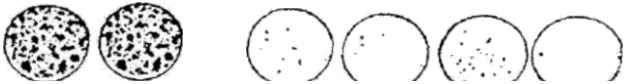
No corrosion-protective effect

Grade 1

Controls

Slight corrosion-protective effect

Grade 2



Controls

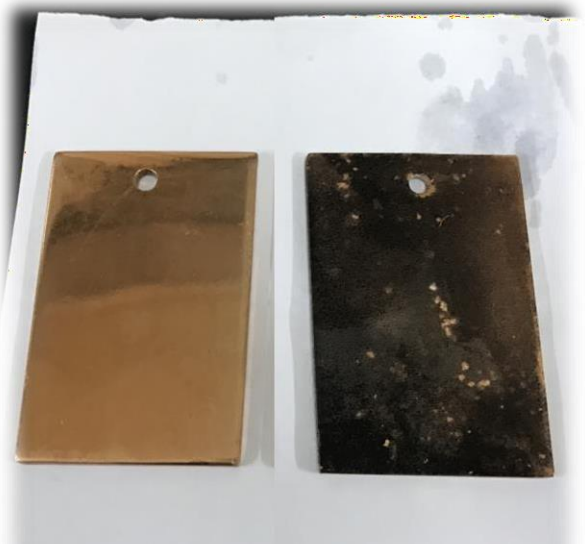
Moderate corrosion-protective effect

Grade 3

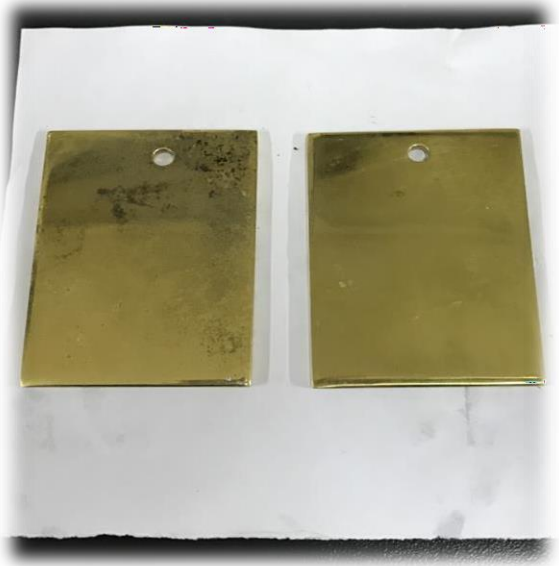
Controls

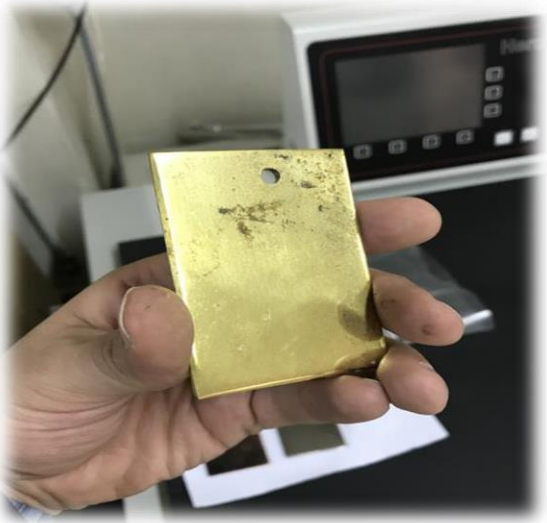
Control sample (VCI-free)

Sample with VCI



Corrosion test on brass (BFSV)





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MIL-STD-1904B standard

INCH-POUND

MIL-STD-1904B (AR)
09 March 2016
SUPERSEDING
MIL-STD-1904A (AR)
1 April 1992

TEST METHOD STANDARD
DESIGN AND TEST REQUIREMENTS
FOR LEVEL A AMMUNITION PACKAGING

MIL22019 standard

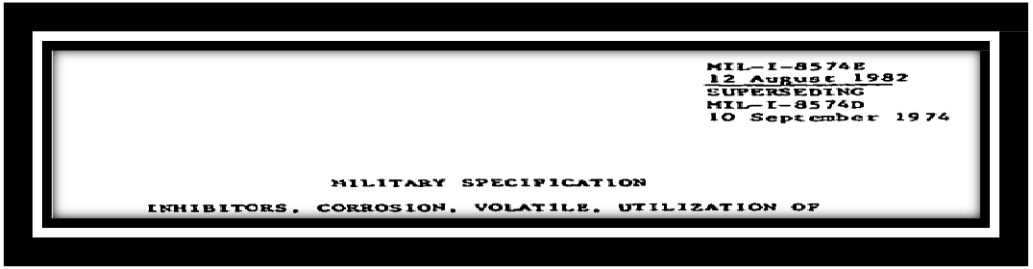
NOT MEASUREMENT SENSITIVE

MIL-PRF-22019E
23 June 2006
SUPERSEDING
MIL-PRF-22019D
w/AMENDMENT 1
14 July 2004

PERFORMANCE SPECIFICATION

BARRIER MATERIALS, TRANSPARENT, FLEXIBLE, SEALABLE, VOLATILE CORROSION INHIBITOR TREATED

MIL-I-8574E standard



MIL-I-8574E
12 August 1982
SUPERSEDING
MIL-I-8574D
10 September 1974

MILITARY SPECIFICATION

INHIBITORS, CORROSION, VOLATILE, UTILIZATION OF

MIL-STD_3010A standard

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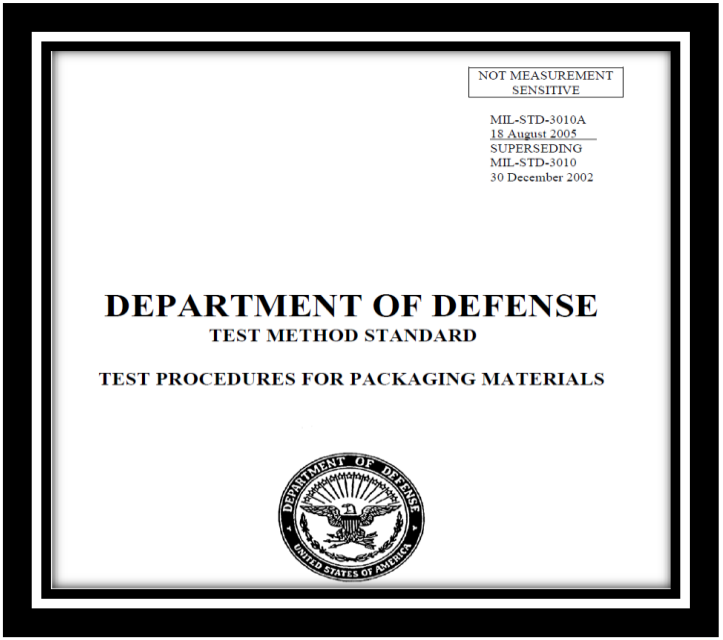


MIL-STD-650 standard

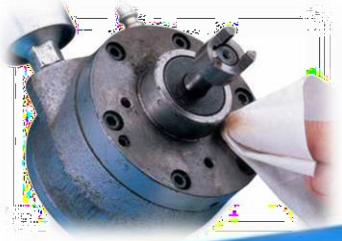
Packaging instructions for storage and transportation by VCI products:

Packaging parts:

Generalities

Assorted VCI products, including shrink wraps, packaging bags and VCI foams have assorted ways of application. It is necessary to follow the general rules in all cases.

After cleaning the parts with a dry cloth, they are inserted in the VCI bags. In case of packaging susceptible parts, they should be cleaned of any acidic or alkaline stains or even fingerprints using non-chlorinated solvents and packed quickly.



Packaging parts:

After inserting the metal parts in the VCI polymer films or bags, they should be sealed by a heat sealer. In case of seeing any holes or tears in the VCI bags, avoid using them. Because their efficiency will be reduced due to the release of corrosion inhibiting gases.

It should be noted that if the pieces to be packaged have sharp edges, it is better to wrap the parts with foams or high-thickness films.

Packaging parts:

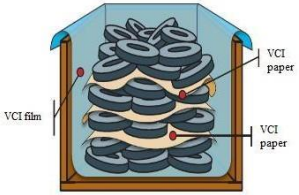
In case of using heat sealers, it is necessary to control the temperature and time of sealing to do it correctly.

During handling, avoid dragging on the ground.

In case of using a forklift, to prevent rupture of packages with the forks, put the packages on the pallets and then move them.

Packaging parts:

If large bags are used for packaging equipment, it is better to put a layer of VCI kraft paper in the packaging.



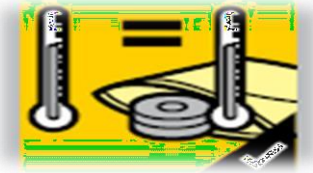
If the parts are packed in wood boxes, it is better to put VCI films in the box; otherwise the efficiency of packaging decreases due to the reaction of wood and moisture and production of acetic acid which accelerates corrosion.

Packaging parts

Steps to proper

Improper packaging

If possible, the parts should be packed at room temperature, around 25 °C. If the packaging is done at a low temperature, the efficiency will decrease. This is due to the presence of ambient moisture and dew formation in the packaging.



The storage duration of the samples varies depending on the storage conditions. Its efficiency and duration of final performance decreases with time. To increase storage duration of the product in the warehouse, it is necessary to observe the following items.

Store VCI packages together in a cool, dry place.

Keep the VCI packages away from direct sunlight or other rays. If you need to use VCI films against sunlight, use VCI films with anti-UV additives.

Keep the VCI packages away from flames.