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## Comparing Armor film to VpCI-126

**To:** Customer

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**Project #:** 13-265-1125.bis

**Results reported by:**

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**Date:** December 6, 2013



**Background:** It was requested that the corrosion protection and mechanical properties of the Armor film be compared to VpCI-126. The Armor bags are used for shipping to Germany.

**Sample Received:**

- 1) Armor film, received 12-02-13, used condition

**Method:**

- 1) VIA Test Method, CC-027
- 2) Razor Blade Test Method, CC-004\*
- 3) Paragon 1000 FTIR, Method CC-006
- 4) Mechanical Properties\*(Performed at Cortec Advanced Film Division)
  - a. Breaking Factor, ASTM D 882-02\*
  - b. Tensile Strength at Break, ASTM D882-02\*
  - c. Elongation at Break, ASTM D882-02\*
  - d. Yield Strength, ASTM D882-02\*
  - e. Dart Drop Impact Resistance, ASTM D 1709-04 Test Method A\*
  - f. Puncture Resistance, MIL-STD-3010 TM 2065\*
  - g. Tear Strength, ASTM D 1922-06A\*
  - h. Coefficient of Friction, ASTM D1894\*
  - i. Seal Strength, ASTM F88-99\*

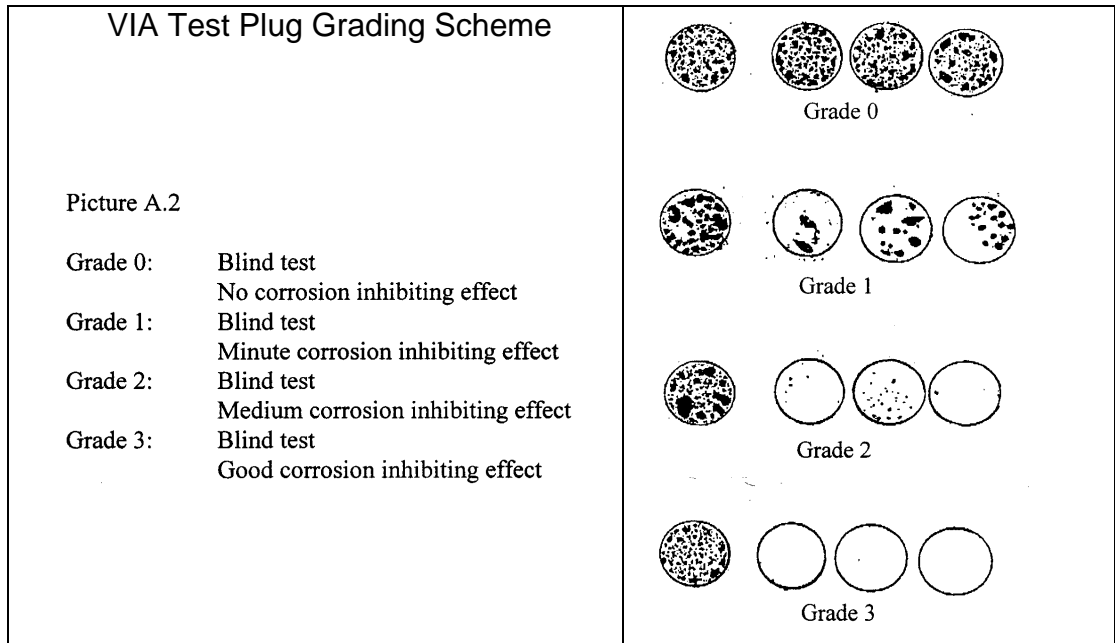
\*Cortec Laboratory is not accredited for the test marked

**Materials:**

- 1) VIA Test Kit
- 2) Razor Blade test kit
- 3) Methanol, lab grade
- 4) Deionized Water
- 5) Paragon 1000 FTIR
- 6) Plain polyethylene, control film
- 7) VpCI-126, Lot 33659

**Procedure:**

- 1) The tests were performed according to standard procedures. The test results for VpCI-126 were taken from QC's random testing results for lot 33659.
- 2) The VIA test was graded according to the following system:



**Results:**

**Razor Blade Test – Carbon Steel**

Sample	Panel 1	Panel 2	Panel 3
Armor Film	Fail	Fail	Fail
VpCI-126	Pass	Pass	Pass
Control	Fail	-	-

**Razor Blade Test – Copper**

Sample	Panel 1	Panel 2	Panel 3
Armor Film	Fail	Fail	Pass
VpCI-126	Pass	Pass	Pass
Control	Fail	-	-

**VIA Test**

Sample	Plug # 1	Plug # 2	Plug # 3	Pass / Fail
Armor Film	Grade 0	Grade 0	Grade 0	Fail
VpCI-126	Grade 3	Grade 3	Grade 3	Pass
Control	Grade 0	N/A	N/A	N/A

Note: Grades 0 and 1 are considered failing. See below for grading scale example.

## Mechanical Properties Test Results

Property		Test Method	Units	Armor	VpCI-126
Breaking Factor	MD	ASTM D882-02	lbs/in	7.26	18.35
	TD			7.21	17.03
Tensile Strength at Break	MD	ASTM D882-02	psi	1831.56	4286.88
	TD			1868.19	4019.20
Elongation at Break	MD	ASTM D882-02	%	535.67	643.85
	TD			720.26	723.59
Yield Strength	MD	ASTM D882-02	psi	1354.49	1462.39
	TD			1061.91	1655.80
Dart Drop Impact Resistance		ASTM D1709-04, Test Method A	grams	63.10	736.67
Puncture Resistance		MIL-STD-3010, TM 2065	lbf	4.19	7.93
Tear Strength	MD	ASTM D1922-06A	gram force	115.20	512.00
	TD			441.60	1619.20
Coefficient of Friction		ASTM D1894	static	0.42	0.45
			kinetic	0.42	0.46
Seal Strength	left	ASTM F88-99	lbs/in	5.63	N/A
	center			6.06	N/A

**Results relate only to the items tested**

**Photos:**



Figure 1. Photo of the Armor film, which has particles in it.

**Interpretations:**

- 1) Based on the corrosion test results, the Armor film does not provide vapor or contact-phase corrosion protection.
- 2) The results for the VpCI-126 film determined it provides good vapor and contact-phase corrosion inhibition.
- 3) The mechanical property results determined that VpCI-126 has higher breaking factor, tensile strength at break, elongation at break (machine direction), yield strength, drop dart impact resistance, puncture resistance and tear strength than the Armor film.
- 4) The Armor film, which can be seen in the photo in figure 1, has poor quality; it is very grainy with possibly unblended pigment.
- 5) The FTIR spectra compares the Armor film to a plain 3 mil polyethylene film, and the films appear to be similar to each other. The results indicate there is little, if any corrosion inhibitor in the Armor film.

