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Certificate of Analysis

Analysis of:	Vapour Phase Corrosion Inhibitors (VCIs)
Description of samples:	Commercial plastic film samples from Cortec and from Grofit Plastics
Identification of samples:	VpCI-129, Cor-Pak Ex VpCI, VpCI-126 Blue and Grofit film MMT 615
Analysed for:	Mr Moti Eshet, Trei-Assar St 32B, Kfar-Saba 44343, Israel
Analysis procedure:	Quantitative Evaluation of Volatile Corrosion Inhibitors
Date samples received:	10 April 2008
Date/s samples analysed:	9 July 2008

1. PROCEDURE

We were asked to measure the corrosion rate and the corrosion inhibition efficiency of Cortec and Grofit Plastics VCI-products for mild steel, galvanised steel, copper and aluminium against atmospheric corrosion. The test was done according *W.Skinner, Corrosion Science, Vol. 35, Nos 5 – 8, pp. 1491-1494: A new method for quantitative evaluation of volatile corrosion inhibitors.*

Analysed by (012-841-4706) **E. Vuorinen (Approved signatory)** **Metrologist**	Checked by **W. Jordaan** **Metrologist**	For Chief Executive Officer
Date of issue 15 July 2008		Certificate number **2008/EV2/29-36**

2. RESULTS

MILD STEEL (EV2/29-36)

SAMPLE	METAL SAMPLES	CORROSION RATE (µm/a)	EFFICIENCY (%)	REMARKS
REFERENCE		254	0	Visible staining
VpCI-129		146	42	Visible staining
Corr-Pak Ex		191	25	Visible staining
VpCi-126		146	42	Visible staining
Grofit film MMT 615		31	85	No visible staining

- The corrosion rate of VpCI-129 was 146 ± 9 µm/a for mild steel. The test panels showed visible staining. The VCI-film from Cortec offers some protection against atmospheric corrosion for mild steel but is not effective.
- The corrosion rate of Corr-Pak Ex VpCI-film was 191 ± 9 µm/a for mild steel. The test panels showed visible staining. The VCI-film from Cortec offers some protection against atmospheric corrosion for mild steel but is not effective
- The corrosion rate of VpCI-film was 146 ± 9 µm/a for mild steel. The test panels showed visible staining. The film from Cortec offers some protection against atmospheric corrosion for mild steel but is not effective.
- The corrosion rate of Grofit film MMT 615 was 31 ± 9 µm/a for mild steel. The test panels showed no visible staining. The VCI-film from Grofit offers protection against atmospheric corrosion for mild steel.

GALVANISED STEEL (EV2/29-36)

SAMPLE	METAL SAMPLES	CORROSION RATE (µm/a)	EFFICIENCY (%)	REMARKS
REFERENCE		112	0	Visible staining
VpCI-129		80	28	Visible staining
Corr-Pak Ex VpCI		86	23	Visible staining
VpCI-126		73	34	Visible staining
Grofit film MMT 615		50	55	No visible staining

- The corrosion rate of VpCI-129 was 80 ± 10 µm/a for galvanised steel. The test panels showed visible staining. The VCI-film from Cortec offers some protection against atmospheric corrosion for galvanised steel but is not effective.
- The corrosion rate of Corr-Pak Ex VpCI-film was 86 ± 10 µm/a for galvanised steel. The test panels showed visible staining. The VCI-film from Cortec offers some protection against atmospheric corrosion for galvanised steel but is not effective.
- The corrosion rate of VpCi-126 was 73 ± 10 µm/a for galvanised steel. The test panels showed visible staining. The film from Cortec offers some protection against atmospheric corrosion for galvanised steel but is not effective.
- The corrosion rate of Grofit film MMT 615 was 50 ± 10 µm/a for galvanised steel. The test panels showed no visible staining. The film from Grofit offers some protection against atmospheric corrosion for galvanised steel.

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COPPER (EV2/29-36)

SAMPLE	METAL SAMPLES	CORROSION RATE (µm/a)	EFFICIENCY (%)	REMARKS
REFERENCE		11	0	Visible staining
VpCI-129		0	> 90	No visible staining
Corr-Pak Ex VpCI		0	>90	No visible staining
VpCI-126		Mass gain	Effective	No visible staining
Grofit film MMT 615		0	>90	No visible staining

- The corrosion rate of VpCI-129 was 0 µm/a for copper. The test panels showed no visible staining. The VCI-film from Cortec offers protection against atmospheric corrosion for copper.
- The corrosion rate of Corr-Pak Ex VpCI was 0 µm/a for copper. The test panels showed no visible staining. The VCI-film from Cortec offers protection against atmospheric corrosion for copper.
- VpCI-126-film did not prevent mass gains of copper. The mass gain was due to the formation of corrosion product films which were not removed during mechanical cleaning exposure. The test panels showed no visible staining. The film from Cortec offers protection against atmospheric corrosion for copper.
- The corrosion rate of Grofit film MMT 615 was 0 µm/a for copper. The test panels showed no visible staining. The VCI-film from Grofit offers protection against atmospheric corrosion for copper.

ALUMINIUM (EV2/29-36)

SAMPLE	METAL SAMPLES	CORROSION RATE (µm/a)	EFFICIENCY (%)	REMARKS
REFERENCE		0.2 mg/72h	0	Visible staining
VpCI-129		Mass gain	Effective	No visible staining
Corr-Pak Ex VpCI		0.2 mg/72h	0	No visible staining
VpCI-126		0.3 mg/72h	0	No visible staining
Grofit film MMT 615		0 mg/72h	>90	No visible staining

- VpCI-129-film did not prevent mass gains of aluminium. The mass gain was due to the formation of corrosion product films which were not removed during mechanical cleaning exposure. The test panels showed no visible staining. The film from Cortec offers protection against atmospheric corrosion for aluminium.
- The corrosion rate of Corr-Pak Ex VpCI was 0.2 mg/72h for aluminium. The test panels showed no visible staining. The VCI-film from Cortec offers no protection against atmospheric corrosion for aluminium.
- The corrosion rate of VpCI-126-film was 0.3 mg/72h for aluminium. The test panels showed no visible staining. The VCI-film from Cortec offers no protection against atmospheric corrosion for aluminium.
- The corrosion rate of Grofit film MMT 615 was 0 mg/72h for aluminium. The test panels showed no visible staining. The VCI-film from Grofit offers protection against atmospheric corrosion for aluminium.

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3. REMARKS

3.1 The results in this report relate only to the sample(s) mentioned herein.

3.2 Certain of the NMISA certificates are consistent with the capabilities that are included in appendix C of the MRA (Mutual Recognition Arrangement) drawn up by the CIPM. Under the MRA, all participating institutes recognise the validity of each other's calibration and measurement certificates for the quantities and ranges and measurement uncertainties specified in Appendix C. For details see http://www.bipm.org.

3.3 The analyses were carried out at an ambient temperature of 17.5°C ± 3.5°C and a relative humidity of 46 %RH ± 23 %RH.

3.4 The final report will be the property of the client and may be published by him, provided that it is published in full, or where only extracts there from or a summary or an abridgement thereof is published, the NMISA's prior written approval of the extracts, summary or abridged report are to be obtained.

3.5 The following equipment was used: water bath (Memmert, Serial number 788125), thermometer (IKA ETS D3, Serial number 777890), balances (Sartorius 2251, Serial number 401053 and Mettler Toledo AG285, number ANA 0038).

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