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REPORT

Testing of the Powder coating system
ZINC RICH EPOXY / EPOXY PHENOLIC /
POLYESTER (DFT 60/80/80 µm) on blasted
steel panels, according to ISO 12944-6 C5-I High

Haarlem, 2 August 2013

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1 INTRODUCTION

1.1 Order

By order of Univercol Paints Ltd. in Israel, the Centrum voor Onderzoek en Technisch advies (COT bv) in Haarlem, The Netherlands has tested the Powder coating system Zinc rich epoxy / Epoxy Phenolic / Polyester, applied on blasted steel panels according to ISO 12944-6 C5-I High.

The order has been given in the email message of March 3rd, 2013.

1.2 General information

Table 1: Samples

COT sample number	Description	Received
27-03-13/0123	16 Coated steel panels with system Zinc rich epoxy / Epoxy Phenolic / Polyester, dimensions 100 x 150 x 5 mm	27 March 2013

2 PAINT APPLICATION

The powder coating system has been applied by Univercol Paints Ltd. on Sa 2½ blasted steel panels.

Specified Dry Film Thickness : Zinc rich epoxy : 60 µm
Epoxy Phenolic : 80 µm
Polyester : 80 µm

Required durability : ISO 12944-6 C5-I High

3 PROCECURE

3.1 Dry film thickness

Before starting the tests the dry film thickness of the coating system has been measured according to ISO 2178 with a magnetic dry film thickness meter (COT E004). On each panel ten measurements have been carried out and the values have been corrected with a correction value of 25 micrometer according to ISO 19840. The minimum, the maximum, the average and the standard deviation have been reported.

3.2 Adhesion

The adhesion of the coating system has been determined by the cross-cut test with the use of a single blade cutting tool in accordance with ISO 2409. The test has been performed on the unexposed reference panels and on the panels which have been exposed in the various artificial ageing tests.

3.3 Neutral Salt Spray

Resistance to neutral salt spray has been tested in accordance with ISO 9227 NSS. Three test panels have been tested during 1440 hours and in the panels a vertical scribe mark has been made through the coating till the substrate using a sharp knife according to ISO 2409.

General data

Apparatus number	: COT S006
Type of water	: Demineralised water (< 1 µS)
Salt	: Sodium chloride (NaCl) p.a.
Test temperature	: 35 °C
Collected salt solution	: 1.0 – 2.0 ml/hour/80 cm ²
pH of the collected salt solution	: 6.5 – 7.2
Salt concentration of the collected solution	: 50 ± 5 g/l
Exposition angle	: ca. 20 ° from the vertical
Start of test	: May 3 rd , 2013
End of test	: July 2 nd , 2013

Immediately after the test the panels have been examined for defects according to ISO 4628 and the corrosion creep from the scribe has been determined according to Annex A of ISO 12944-6. The adhesion has been determined according to ISO 2409 after a 24 hours recovery period.

3.4 Water Condensation Test

Resistance to water condensation has been tested in accordance to ISO 6270-1. Three test panels have been tested during 720 hours.

General data

Apparatus	: Cleveland condensation tester
Temperature of the air space	: 38 ± 2 °C
Temperature environment	: 23 ± 2 °C
Exposition angle	: ca. 60 ° to the horizontal
Start of test	: May 7 th , 2013
End of test	: June 6 th , 2013

Immediately after the test the panels have been examined for defects according to ISO 4628. The adhesion has been determined according to ISO 2409 after a 24 hours recovery period.

3.5 Chemical resistance

The chemical resistance has been tested according to ISO 2812-1 in three test solutions:

- 10 % (m/m) Sodium Hydroxide aqueous solution
- 10 % (m/m) Sulphuric acid aqueous solution
- Mineral spirit, 18 % aromatics

In each solution three panels have been immersed for 60 % for a period of 168 hours.

The test temperature was 23 ± 2 °C and the start of the 3 immersion tests was May 7th 2013 and the tests have been ended May 14th 2013.

Immediately after the test the panels have been examined for defects according to ISO 4628. The adhesion has been determined according to ISO 2409 after a 24 hours recovery period.

4 RESULTS

4.1 Assessment before tests

Table 2: Adhesion before tests

Cross-cut test ISO 2409 (3 mm)	COT sample number 27-03-13/0123		Requirements
	Panel 5		
Min. – max. DFT (µm)	181-262		
Average DFT (µm)	219 ± 27		Maximum 264 µm
ISO 2409 Classification	0		0 or 1

4.2 Assessment after Neutral Salt Spray test

Table 3: Assessment after neutral salt spray test

1440 hours ISO 9227 NSS	COT Sample number 27-03-13/0123			Requirements
	Panel 7	Panel 9	Panel 13	
Min. – max. DFT (µm)	219-283	223-258	172-244	
Average DFT (µm)	248 ± 23	238 ± 11	195 ± 22	Maximum 264 µm
ISO 4628-2 (blistering)	0(S0)	0(S0)	0(S0)	0(S0)
ISO 4628-3 (rusting)	Ri0	Ri0	Ri0	Ri0
ISO 4628-4 (cracking)	0(S0)	0(S0)	0(S0)	0(S0)
ISO 4628-5 (flaking)	0(S0)	0(S0)	0(S0)	0(S0)
Annex A (corrosion of the substrate from the scribe) (mm)	0,3	2,5	0,3	Not exceed 1 mm
ISO 2409 Classification	0	0	0	0 or 1

4.3 Assessment after Water Condensation test

Table 4: Assessment after condensation test

720 hours ISO 6270-1	COT Sample number 27-03-13/0123			Requirements
	Panel 6	Panel 8	Panel 10	
Min. – max. DFT (µm)	233-276	215-257	181-228	
Average DFT (µm)	247 ± 14	238 ± 15	198 ± 13	Maximum 264 µm
ISO 4628-2 (blistering)	0(S0)	0(S0)	0(S0)	0(S0)
ISO 4628-3 (rusting)	Ri0	Ri0	Ri0	Ri0
ISO 4628-4 (cracking)	0(S0)	0(S0)	0(S0)	0(S0)
ISO 4628-5 (flaking)	0(S0)	0(S0)	0(S0)	0(S0)
ISO 2409 Classification	0	0	0	0 or 1

4.4 Assessment after Chemical Resistance test

Table 5: Assessment after 168 hours in 10 % H₂SO₄.

168 hours in 10 % H ₂ SO ₄ ISO 2812-1	COT sample number 27-03-13/0123			Requirements
	Panel 1	Panel 11	Panel 16	
Min. – max. DFT (µm)	184-243	232-272	220-256	
Average DFT (µm)	210 ± 17	258 ± 11	234 ± 11	Maximum 264 µm
ISO 4628-2 (blistering)	0(S0)	0(S0)	0(S0)	0(S0)
ISO 4628-3 (rusting)	Ri 0	Ri 0	Ri 0	Ri 0
ISO 4628-4 (cracking)	0(S0)	0(S0)	0(S0)	0(S0)
ISO 4628-5 (flaking)	0(S0)	0(S0)	0(S0)	0(S0)
ISO 2409 Classification	0	0	0	0 to 1

Table 6: Assessment after 168 hours in 10 % NaOH

168 hours in 10 % NaOH ISO 2812-1	COT sample number 27-03-13/0123			Requirements
	Panel 2	Panel 4	Panel 15	
Min. – max. DFT (µm)	234-274	176-237	212-268	
Average DFT (µm)	256 ± 15	215 ± 23	236 ± 17	Maximum 264 µm
ISO 4628-2 (blistering)	0(S0)	0(S0)	0(S0)	0(S0)
ISO 4628-3 (rusting)	Ri 0	Ri 0	Ri 0	Ri 0
ISO 4628-4 (cracking)	0(S0)	0(S0)	0(S0)	0(S0)
ISO 4628-5 (flaking)	0(S0)	0(S0)	0(S0)	0(S0)
ISO 2409 Classification	0	0	0	0 to 1

Table 7: Assessment after 168 hours in Mineral Spirit


168 hours in Mineral Spirit ISO 2812-1	COT sample number 27-03-13/0123			Requirements
	Panel 3	Panel 12	Panel 14	
Min. – max. DFT (µm)	235-290	241-286	184-281	
Average DFT (µm)	261 ± 19	259 ± 12	224 ± 29	Maximum 264 µm
ISO 4628-2 (blistering)	0(S0)	0(S0)	0(S0)	0(S0)
ISO 4628-3 (rusting)	Ri 0	Ri 0	Ri 0	Ri 0
ISO 4628-4 (cracking)	0(S0)	0(S0)	0(S0)	0(S0)
ISO 4628-5 (flaking)	0(S0)	0(S0)	0(S0)	0(S0)
ISO 2409 Classification	0	0	0	0 to 1

5 CONCLUSION

The Powder coating system Zinc rich epoxy / Epoxy Phenolic / Polyester applied on blasted steel panels, dry film thickness 60/80/80 µm (COT sample number 27-03-13/0123) meets the requirements of ISO 12944-6 C5-I High.

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