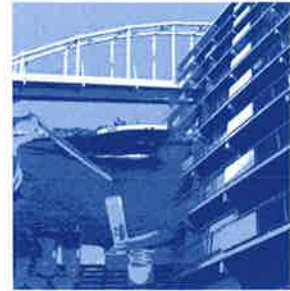




COT bv
Independent advice,
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REPORT

Testing coated samples, with COT sample number 07-11-17/0712 according to ISO 12944-6 C5I Medium

Haarlem, April 10th, 2018

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Report number : LAB18-0113-REP Revision 2

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1 INTRODUCTION

1.1 Order

By order of Zingametall BVBA in Eke, Belgium, the Centrum voor Onderzoek en Technisch advies (COT bv) in Haarlem, The Netherlands, has tested the samples with COT sample number 07-11-17/0712 according to ISO 12944-6 C5I Medium.

The order is given in a letter enclosed to the panels received 07-11-2017.

Tests marked with 'Q' are under accreditation according to ISO/IEC 17025 with registration number L535.

1.2 General information

Table 1: Received samples

COT sample number	Sample	Received
07-11-17/0712	11 coated steel panels*, dimensions 100 x 150 x 3 mm	07-11-2017

*) numbered by the client.

The coating system has been applied on the test panels by the client. The following information has been received from the client.

Substrate

Steel panels.

Surface preparation

Unknown

Coating system description

90 micron DFT Zinga System

Test specification : ISO 12944-6
Corrosivity category : C5-I
Durability range : Medium

2 PROCEDURE

2.1 Determination of the dry film thickness using a magnetic induction gauge, ISO 17025 Scope number 1 (Q)

Before starting the tests the total dry film thickness of the coating system has been measured according to ISO 2808:7C, COT Instruction 30.01.12-2 with a magnetic dry film thickness meter (COT E004) and corrected for surface roughness (C = correction value) according to ISO 19840. On each panel 5 measurements have been carried out.

2.2 Adhesion, assessing the resistance of paint coatings to separation from substrates when a right-angle lattice pattern is cut into the coating, penetrating through to the substrate, ISO 17025 Scope number 3 (Q)

The adhesion of the coating system has been determined according to ISO 2409 COT Instruction 30.01.20-1 by the cross-cut test using a single blade cutting tool according to ISO 2409. Distance between incisions is determined by the nDFT of the coating system:

- <60 µm: 1 mm,
- 60-120 µm: 2 mm,
- 120-250 µm: 3 mm,
- >250 µm: method unsuitable.

Loose paint will be removed using ISO 2409 method A1 (brushing).

On each panel three to six trials have been performed and all individual values have been reported. Before testing the panels have been conditioned for a minimum period of 16 hours at 23 ± 2 °C and 50 ± 5 % R.H., the test has been performed under the same conditions.

2.3 Determination of the resistance against corrosion in artificial atmospheres, Neutral salt spray, ISO 17025 Scope number 4 (Q)

Resistance to Neutral Salt Spray (NSS) has been tested in accordance with ISO 9227 NSS, COT Instruction 30.01.27-1 on three test panels.

General data

Apparatus number	: COT S008
Type of water	: Demineralised water (< 1 µS)
Salt	: Sodium chloride (NaCl) p.a.
Test temperature	: 35 ± 2 °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	: approx. 20 ° from the vertical
Test duration	: 720 hours
Scribe	: Vertical 0.05 mm wide and 50 mm long

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 after a 24 hours recovery period.

After the assessments photos have been taken (See Annex).



2.4 Determination of the resistance to Humidity-CH test, ISO 17025 Scope number 6 (Q)

Resistance to water condensation has been tested in accordance with ISO 6270-1, COT Instruction 30.01.41 on three test panels.

General data

Apparatus	: Cleveland condensation tester (COT C001)
Temperature of the air space	: 38 ± 2 °C
Temperature environment	: 23 ± 2 °C
Exposition angle	: approx. 60 ° to the horizontal
Test duration	: 480 hours
Scribe	: None

Immediately after the test, the panels have been examined for defects according to ISO 4628. The adhesion has been determined after a 24 hours recovery period. After the assessments photos have been taken (See Annex).

2.5 Kesternich test

Panels are exposed to Sulphur Dioxide (SO₂) testing in an airtight cabinet with a capacity of 180 litre according to ISO 3231 (Kesternich test)

General data

Test conditions	: 8 hours at 40 ± 3 °C and Relative Humidity (R.H.) 100 % 16 hours ambient atmosphere (23 ± 5 °C and R.H. < 75 %)
Sulphur dioxide	: 0.2 litres SO ₂
No. of cycles	: 20
Start of the test	: 12 th January, 2018
End of the test	: 9 th February 2018

At the end of 20 cycles, the samples are blotted and immediately examine the whole surface for any defects. The photographs are presented in Annex.



3 REQUIREMENTS

3.1 Reference adhesion before tests

Table 2: Adhesion before tests

Adhesion ISO 2409 (ISO 17025 Scope number 3)		Requirements
ISO 2409	Individual values	Class 0-1

3.2 Assessment after Neutral Salt Spray test

Table 3: Assessment after Neutral Salt Spray test

Neutral salt spray ISO 9227- 5.2 NSS, 720 hours (ISO 17025 Scope number 4)		Requirements
ISO 4628-2	Blistering	0(S0)
ISO 4628-3	Rusting	Ri 0
ISO 4628-4	Cracking	0(S0)
ISO 4628-5	Flaking	0(S0)
Corrosion from scribe		≤ 1 mm
ISO 2409	Individual values	Class 0-1

Only one of the three panels shall be allowed not to comply with the requirements

3.3 Assessment after Condensation test

Table 4: Assessment after Condensation test

Condensation ISO 6270-1, 480 hours (ISO 17025 Scope number 6)		Requirements
ISO 4628-2	Blistering	0(S0)
ISO 4628-3	Rusting	Ri 0
ISO 4628-4	Cracking	0(S0)
ISO 4628-5	Flaking	0(S0)
ISO 2409	Individual values	Class 0-1

Only one of the three panels shall be allowed not to comply with the requirements.

3.4 Assessment after Kesternich test

Table 5: Assessment after 20 cycles Sulphur Dioxide

Kesternich ISO 3231		Requirements
ISO 4628-2	Blistering	0(S0)
ISO 4628-3	Rusting	Ri 0
ISO 4628-4	Cracking	0(S0)
ISO 4628-5	Flaking	0(S0)
ISO 2409	Individual values	Class 0-1

Only one of the three panels shall be allowed not to comply with the requirements.



4 RESULTS

4.1 Dry film thickness

Table 5: Dry film thickness test panels. (ISO 17025 Scope number 1) Test date: 01-03-2018

Q	Dry film thickness ISO 2808 (C = 25 µm)	COT sample number 07-11-17/0712				
		Panel 1	Panel 2	Panel 3	Panel 4	Panel 5
	Readings (n=5)	100	104	90	85	102
		104	97	103	87	94
		85	99	95	99	105
		89	97	90	89	95
		89	90	92	90	85
	Min. - Max. (µm)	85 - 104	90 - 104	90 - 103	85 - 99	85 - 105
	Average, SD (µm)	93 ± 8	97 ± 5	94 ± 5	90 ± 5	96 ± 8
	Readings (n=5)	Panel 6	Panel 7	Panel 8	Panel 10	Panel 13
		116	94	79	74	105
		102	89	84	84	103
		94	109	98	102	113
		105	90	89	86	105
	Min. - Max. (µm)	94 - 116	89 - 109	79 - 98	74 - 102	103 - 113
	Average, SD (µm)	103 ± 8	96 ± 8	88 ± 7	89 ± 12	108 ± 5
	Readings (n=5)	Panel 15				
		104				
		112				
		113				
		97				
	Min. - Max. (µm)	97 - 114				
	Average, SD (µm)	108 ± 7				

4.2 Assessment before tests

Table 6: Reference assessment of coating adhesion. (ISO 17025 Scope number 3)
Test date: 12-12-2017

Q	Reference Adhesion ISO 2409 cross-cut test No exposure	COT sample number 07-11-17/0712		
		Panel 8	Panel 13	Panel -
	Adhesion (Class)	0 / 0 / 2 / 1 / 1 / 0	1 / 1 / 2 / 2 / 1 / 0	--

4.3 Assessment after Neutral Salt Spray test

Table 7: Assessment after Neutral Salt Spray test. (ISO 17025 scope number 4)
Test date: 16-01-2018 until 15-02-2018

Q	Neutral salt spray ISO 9227 - 5.2 NSS Exposure 720 hours	COT sample number 07-11-17/0712		
		Panel 5	Panel 6	Panel 7
Q	ISO 4628-2 Blistering	0(S0)	0(S0)	0(S0)
Q	ISO 4628-3 Rusting	Ri 0	Ri 0	Ri 0
Q	ISO 4628-4 Cracking	0(S0)	0(S0)	0(S0)
Q	ISO 4628-5 Flaking	0(S0)	0(S0)	0(S0)
	Corrosion from scribe (mm)	1	0	0
Q	ISO 2409 Adhesion (Class)	1 / 1 / 1	0 / 1 / 1	1 / 1 / 1

4.4 Assessment after Condensation test

Table 8: Assessment after Condensation test. (ISO 17025 scope number 6)
Test date: 16-01-2018 until 5-02-2018

Q	Condensation ISO 6270-1 Exposure 480 hours		COT sample number 07-11-17/0712		
			Panel 4	Panel 10	Panel 15
Q	ISO 4628-2	Blistering	0(S0)	0(S0)	0(S0)
Q	ISO 4628-3	Rusting	Ri 0	Ri 0	Ri 0
Q	ISO 4628-4	Cracking	0(S0)	0(S0)	0(S0)
Q	ISO 4628-5	Flaking	0(S0)	0(S0)	0(S0)
Q	ISO 2409 Adhesion	Adhesion (Class)	0 / 1 / 1	1 / 1 / 1	0 / 1 / 1

4.5 Assessment after Kesternich test

Table 9: Assessment after Kesternich test
Test date: 12-01-2018 until 09-02-2018

	Sulphur Dioxide ISO 3231 Exposure 20 cycles		COT sample number 07-11-17/0712		
			Panel 1	Panel 2	Panel 3
	ISO 4628-2	Blistering	0(S0)	0(S0)	0(S0)
	ISO 4628-3	Rusting	Ri 0	Ri 0	Ri 0
	ISO 4628-4	Cracking	0(S0)	0(S0)	0(S0)
	ISO 4628-5	Flaking	0(S0)	0(S0)	0(S0)
	ISO 2409	Adhesion (Class)	1 / 1 / 1	0 / 1 / 1	0 / 1 / 1

5 SUMMARY

Table 10: Summary of the test results of samples with sample number 07-11-17/0712

Test method	Test	Pass / Fail
Reference adhesion (ISO 17025 scope number 3)	-	Pass
Neutral Salt Spray ISO 9227 (ISO 17025 scope number 4)	720 hours	Pass
Condensation test ISO 6270-1 (ISO 17025 scope number 6)	480 hours	Pass
Kesternich test (Sulphur Dioxide)	20 Cycles	Pass

6 CONCLUSION

The coated samples with COT sample number 07-11-17/0712, meet the requirements of ISO 12944-6 C5I Medium and ISO 12944-6 C4 High..

CENTRUM VOOR ONDERZOEK
EN TECHNISCH ADVIES (COT bv)

ba 

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ANNEX

Photographs

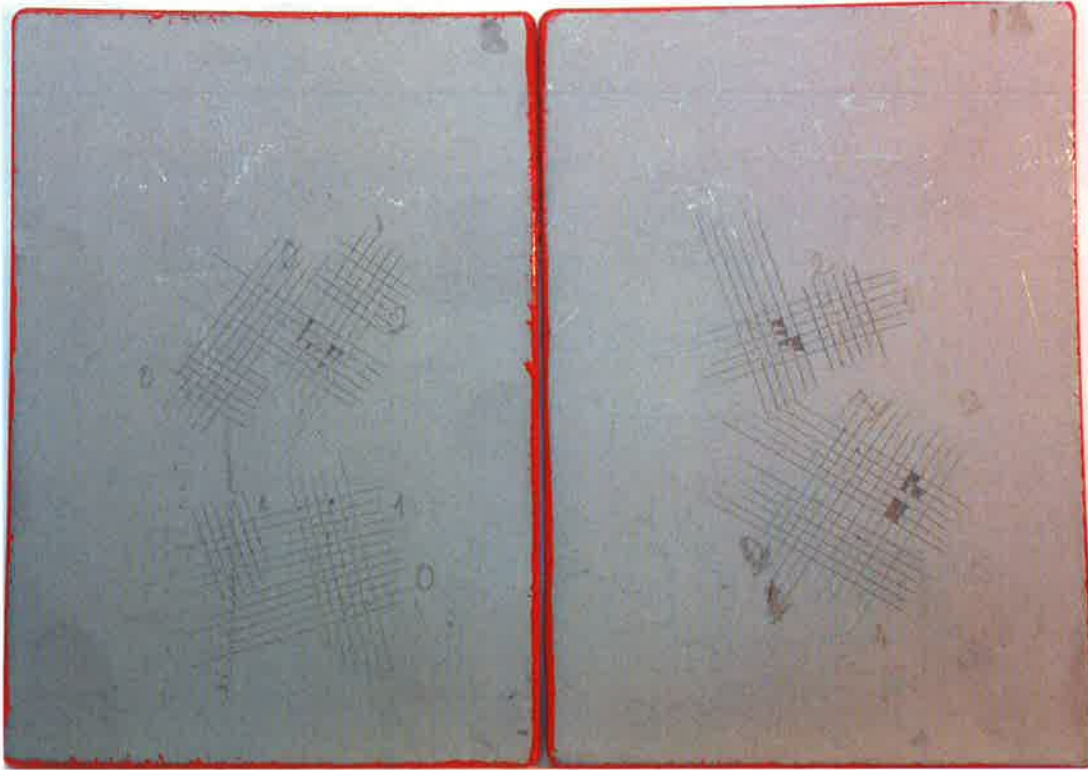


Photo 1: Reference adhesion.

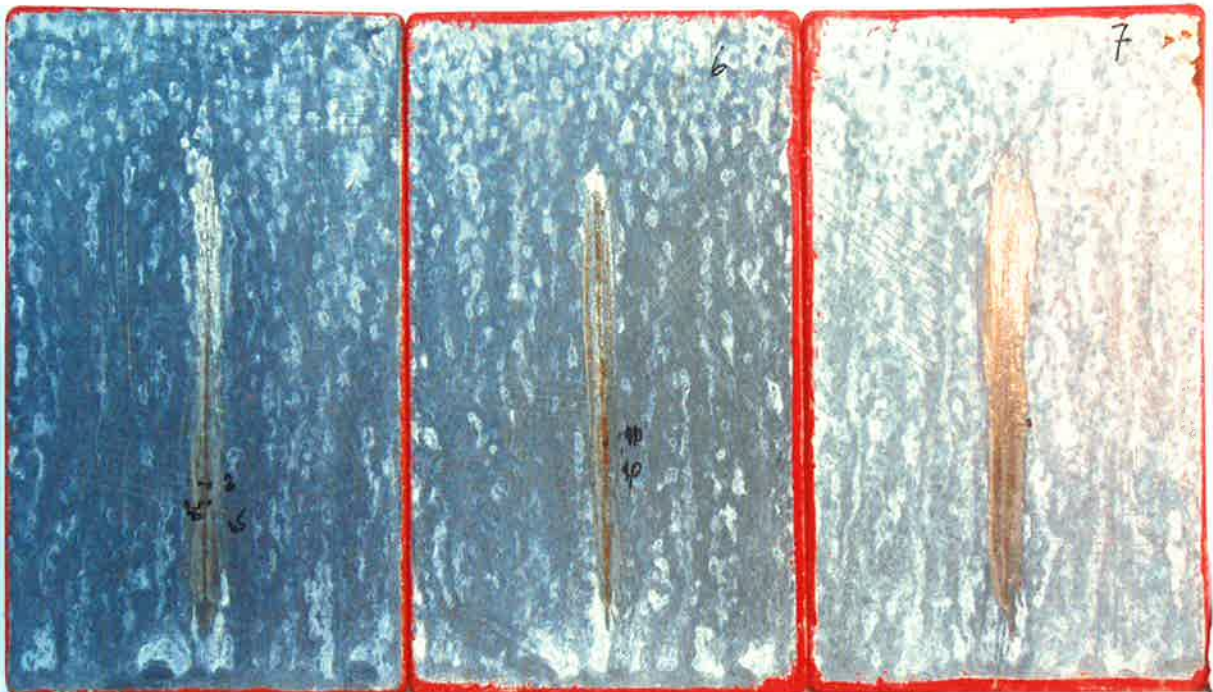


Photo 2: After Neutral Salt Spray test.

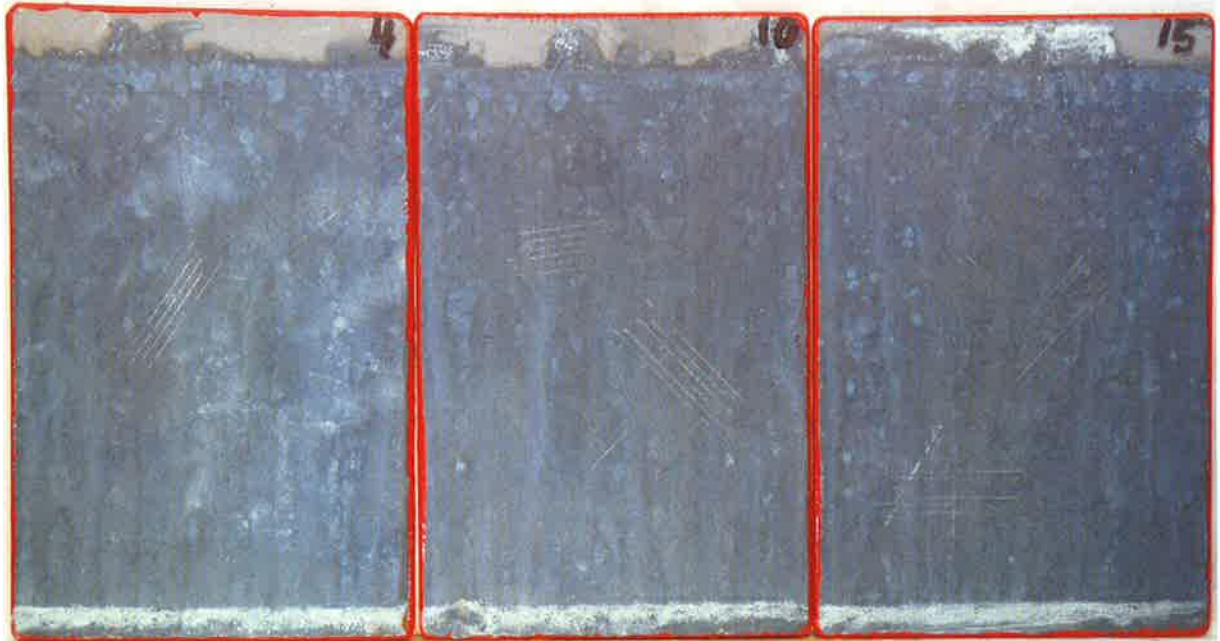


Photo 3: After Condensation test

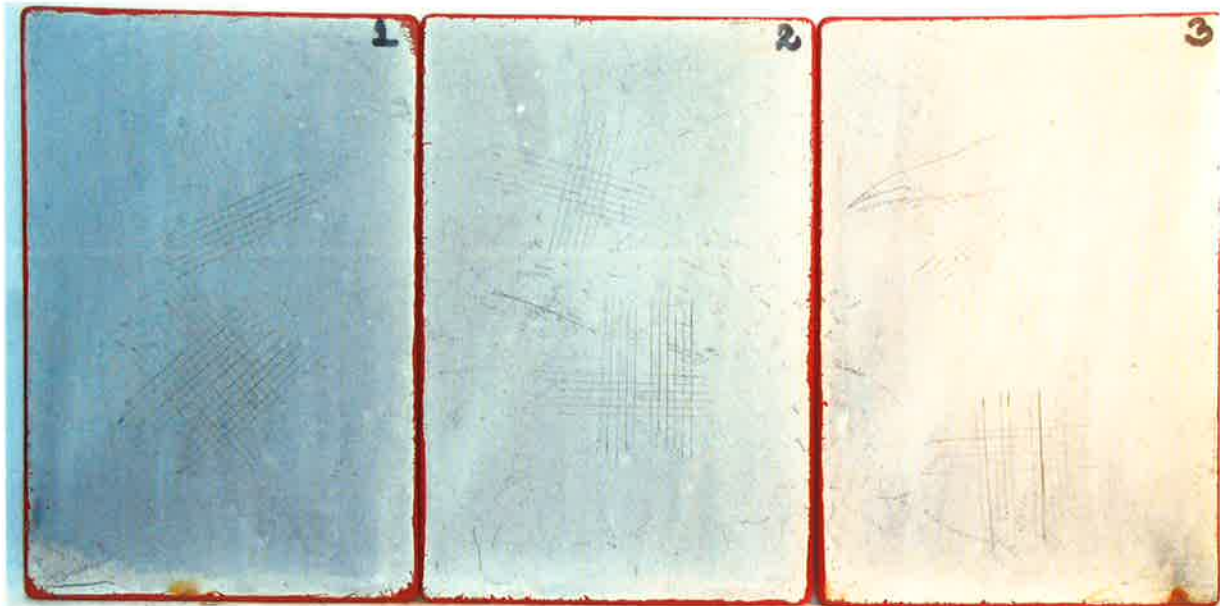


Photo 4: After Sulphur Dioxide test.