COT bv
Independent advice, research and management for construction and industry

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REPORT

Testing coated samples
with COT sample number 01-03-18/0098 and 13-06-18/0387
according to ISO 12944-6 C4 High

Haarlem, August 6th, 2018

Client	:	Kanat Boyacilik Tic. ve SAN A.S. Kemalpasa O.S.B. Mah. Izmir Ankara Yolu No:321 Kemalpasa IZMIR Turkey Contact person: Mr. Ulas Atikler
Project number	:	20180079
Report number	:	LAB18-0341-REP
Handled by	: :	Ms. Ing. N. Lapère Ms. F. F. Sudarso

CONTENTS

1 INTRODUCTION

1.1 Order

By order of Kanat in Izmir, Turkey, the Centrum voor Onderzoek en Technisch advies (COT bv) in Haarlem, The Netherlands, has tested according to ISO 12944-6 C4 High the samples with COT sample number 01-03-18/0098 and 13-06-18/0387

The order has been confirmed by email from Mr. Atikler to Mr Alblas, dated February 21st and 25th May 2018.

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
01-03-18/0098	8 Grey coated steel panels, dimensions 100 x 150 x 3 mm, numbered* 2.1 - 2.8 Designated as system 2	1-3-2018
13-06-18/0387	3 Off white, semi -gloss dimensions 100 x 150 x 3 mm, numbered* 1 - 3 Designated as system 2	13-6-2018

*) numbered by the client.

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

Substrate
Carbon steel panels.

Surface preparation
Blasted to Sa 2.5 grade cleanliness according to ISO 8501-1.
Surface roughness 70-80 µm.

Coating system build up and specified dry film thickness
System description

11080 Kanepox shop primer-RC	:	20 µm
12200 Kanepox Unifast	:	100 µm
37770 Kanpoly ACR Enamel HS	:	60 µm
Total nominal dry film thickness (nDFT)	:	180 µm

Test specification	: ISO 12944-6
Corrosivity category	: C4
Durability range	: High

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 DFT 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 7 days at 23 ± 2 °C and 50 ± 5 % R.H., the test has been performed under the same conditions.

2.3 Pull-off adhesion

The adhesion of the coating system has been determined by a hydraulic adhesion tester (COT A004) in accordance with ISO 4624 Method B.
The coating surface and the dolly (diameter 20 mm) have been sanded lightly and the epoxy adhesive has been applied. After curing of the adhesive and prior to testing, the coating and the adhesive have been scribed around the dolly down to the bare metal.

On each panel three trials have been performed.
Before testing the panels have been conditioned for 7 at 23 ± 2 °C and 50 ± 5 % R.H., the test has been performed under the same conditions.

The fractures of the adhesion test have been evaluated according to the scheme underneath:

A/B	Fracture between the steel surface and 1st coat (adhesion failure).
B	Fracture in the 1st coat (cohesion failure).
B/C	Fracture between the 1st and 2nd coat (adhesion failure).
C	Fracture in the 2nd coat (cohesion failure).
C/D	Fracture between the 2nd and 3rd coat (adhesion failure).
D	Fracture in the 3rd coat (cohesion failure)
-/Y	Fracture between the final coat and the adhesive (adhesive failure).
Y	Fracture in the adhesive (cohesion failure)

2.4 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. The fully cured coating system has been scribed horizontally down to the steel substrate, the scribe line being 2 mm wide and 50 mm long.

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

Immediately after exposure the panels were evaluated for visual surface defects according to ISO 4628-2, -3, -4 and -5.

The corrosion at the scribe has been determined within 8 hours after the end of the exposure.
The corrosion at the scribe is calculated from the equation: M=(C-W)/2, where
M = corrosion creep (mm)
C = average of the nine measurements (mm)
W = the original width of the scribe (mm)

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

2.5 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).

3 REQUIREMENTS

Only one of the three panels shall be allowed not to comply with the 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 0-2
Adhesion ISO 4624		**Requirements**
ISO 4624	Individual values	≥ 2.5 MPa
	Break Area	No A/B break unless ≥ 5 MPa

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		≤ 1.5 mm
ISO 2409	Individual values	Class 0-2
ISO 4624	Individual values	≥ 2.5 MPa
	Break Area	No A/B break unless ≥ 5 MPa

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 0-2
ISO 4624	Individual values	≥ 2.5 MPa
	Break Area	No A/B break unless ≥ 5 MPa

4 RESULTS

4.1 Dry film thickness

Table 5: Dry film thickness test panels. (ISO 17025 Scope number 1)
Test date: 9-03-2018

Q	Dry film thickness ISO 19840 (C = 25 µm)	COT sample number 01-03-18/0098			
		Panel 2.1	**Panel 2.2**	**Panel 2.3**	**Panel 2.4**
	Readings (n=5)	150 143 150 156 149	192 171 185 185 184	155 172 172 184 183	182 169 200 193 181
	Min. - Max. (µm)	143 - 156	171 - 192	155 - 184	169 - 200
	Average, SD (µm)	150 ± 5	183 ± 8	173 ± 12	185 ± 12
		Panel 2.5	**Panel 2.6**	**Panel 2.7**	**Panel 2.8**
	Readings (n=5)	158 148 170 170 165	163 156 171 169 155	157 159 175 161 162	179 173 199 197 195
	Min. - Max. (µm)	148 - 170	155 - 171	157 - 175	173 - 199
	Average, SD (µm)	162 ± 9	163 ± 7	163 ± 7	189 ± 12

Table 6: Dry film thickness test panels. (ISO 17025 Scope number 1)
Test date: 18-06-2018

Q	Dry film thickness ISO 2808-7C (C = 25 µm)	COT sample number 13-6-18/0387		
		Panel 1	**Panel 2**	**Panel 3**
	Readings (n=5)	171 172 184 170 170	184 192 205 193 189	161 165 180 177 177
	Min. - Max. (µm)	170 - 184	184 - 205	161 - 180
	Average, SD (µm)	173 ± 6	193 ± 8	172 ± 8

4.2 Assessment before tests

Table 7: Reference assessment of coating adhesion. (ISO 17025 Scope number 3)
Test date: 09-04-2018

Q	Reference Adhesion ISO 2409 cross-cut test No exposure		COT sample number 01-03-18/0098	
			Panel 2.1	Panel 2.2
	Adhesion	(Class)	0 / 0 / 0	0 / 0 / 0

Table 8: Reference assessment of coating adhesion.
Test date: 09-04-2018

Reference Adhesion ISO 4624 Pull-off test No exposure		COT sample number 01-03-18/0098	
		Panel 2.1	Panel 2.2
Adhesion strength Break area	(MPa), (%)	5.4 100% B	5.0 100% B
		4.2 95% B 5% -/Y	4.3 100% B
		4.3 100% B	5.5 100% B

4.3 Assessment after Neutral Salt Spray test

Table 9: Assessment after Neutral Salt Spray test. (ISO 17025 Scope number 4)
Test date: 13-03-2018 till 12-04-2018, adhesion 19-04-2018

Q	Neutral salt spray ISO 9227 - 5.2 NSS Exposure 720 hours		COT sample number 01-03-18/0098		
			Panel 2.3	Panel 2.4	Panel 2.5
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)		0.8	1.1	1.1
Q	ISO 2409	Adhesion(Class)	1 / 1 / 2	2 / 1 / 1	1 / 1 / 2
	ISO 4624	Adhesion(MPa) Break area (%)	7.7 100% B	6.3 100% B	6.2 100% B
			7.8 100% B	5.8 100% B	7.0 100% B
			6.9 90% B, 10% -/Y	6.0 100% B	5.1 100% B

4.4 Assessment after Condensation test

Table 10: Assessment after Condensation test. (ISO 17025 Scope number 6)
Test date: 19-06-2018 until 9-07-2018

Q	Condensation ISO 6270-1 Exposure 480 hours		COT sample number 13-6-18/0387		
			Panel 1	Panel 2	Panel 3
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)
	ISO 4624	Adhesion (MPa) Break area (%)	4.4 40%Y, 10%-/Y, 35% C, 15% B	5.1 35%Y, 15% -/Y, 60% C	3.8 50% Y, 25% -/Y, 20% C, 5% B
			4.0 40% Y, 10%-/Y, 50% C	5.8 40% Y, 10% -/Y, 50% C	4.5 65% Y, 10% -/Y 25%C
			4.1 85% Y, 15% C	4.3 23% Y, 50% -/Y, 30% C	6.8 30% Y, 70% C
Q	ISO 2409	Adhesion (Classification)	0 / 0 / 0	0 / 0 / 0	0 / 0 / 0

5 SUMMARY

Table 11: Summary of the test results.

Test method	Test duration	Pass / Fail
COT sample number 01-03-18/0098		
Reference adhesion	N.A.	Pass
Neutral Salt Spray ISO 9227 (ISO 17025 Scope number 4)	720 hours	Pass
COT Sample number 13-06-18/0387		
Condensation test ISO 6270-1 (ISO 17025 Scope number 6)	480 hours	Pass

6 CONCLUSION

The coated samples with COT sample number 01-03-18/0098 and 13-06-18/0387 meet the requirements of ISO 12944-6 C4H High.

CENTRUM VOOR ONDERZOEK
EN TECHNISCH ADVIES (COT bv)

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ANNEX

Photographs

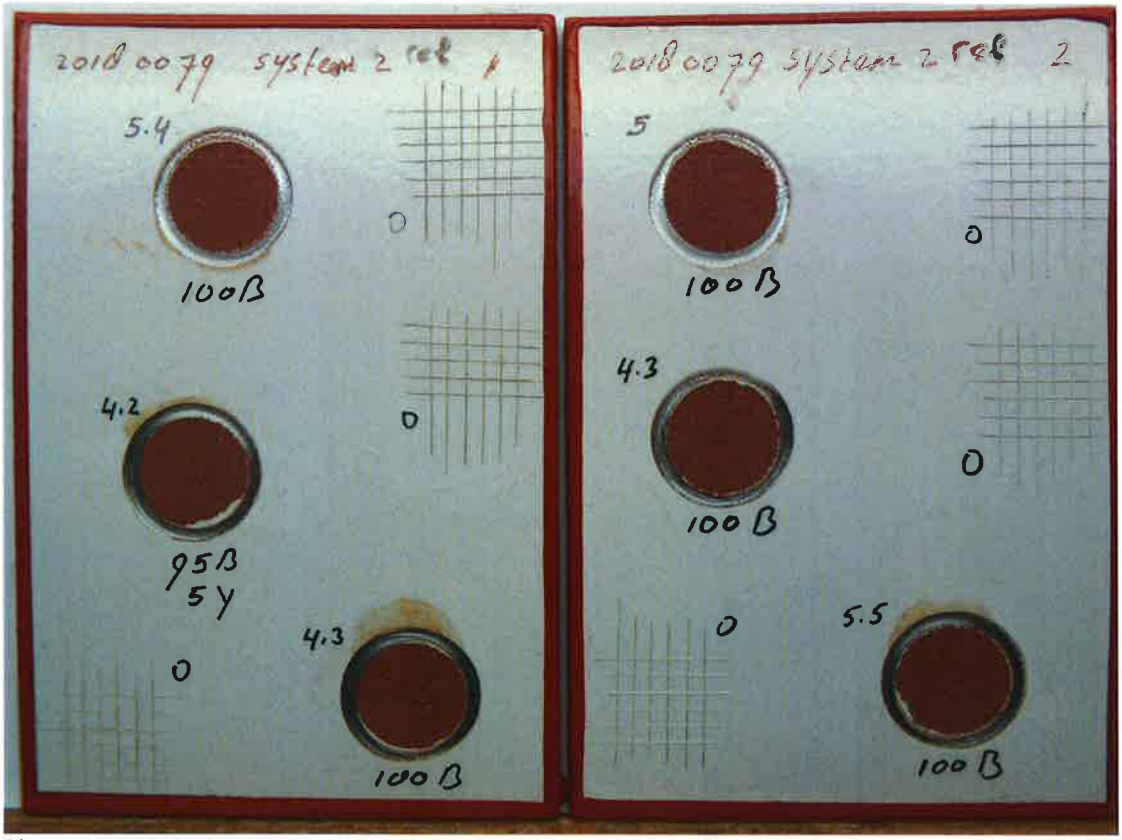

Photo 1: Panels 2.1 and 2.2 Reference adhesion.

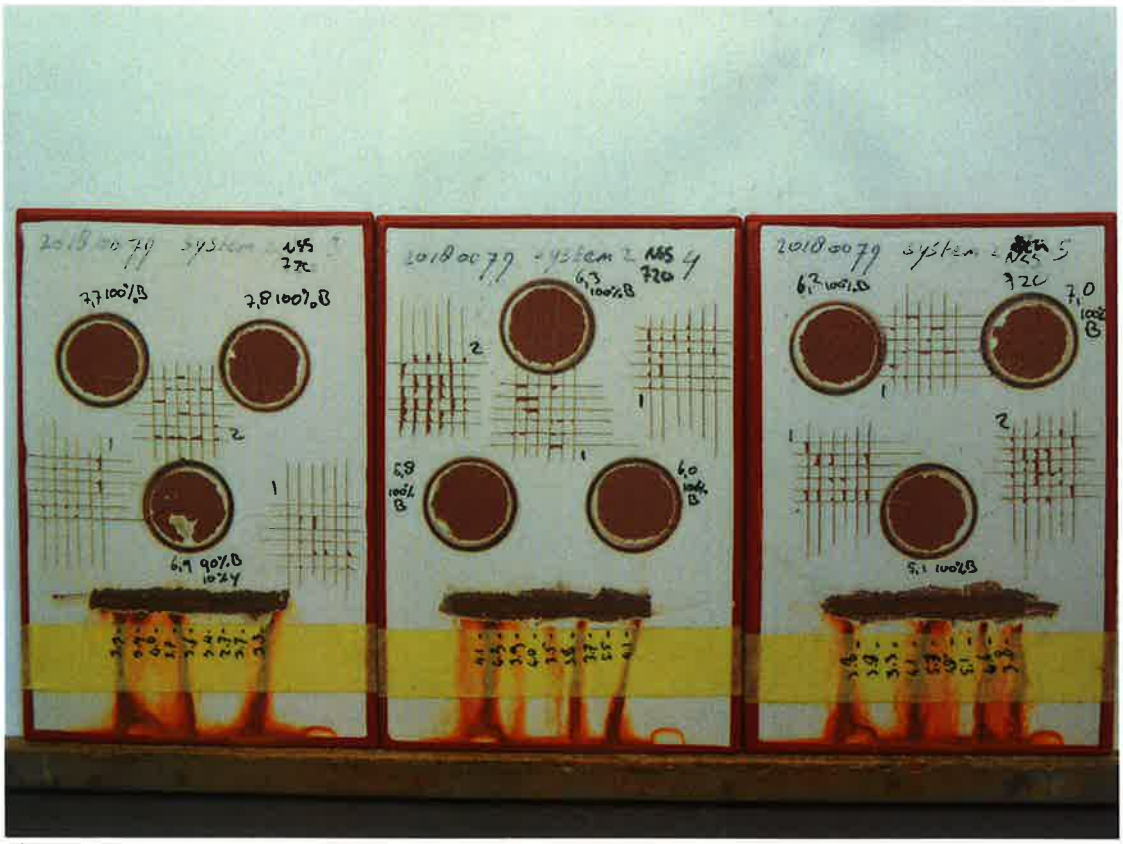

Photo 2: Panels 2.3, 2.4 and 2.5 after 720 hours Neutral Salt Spray test.

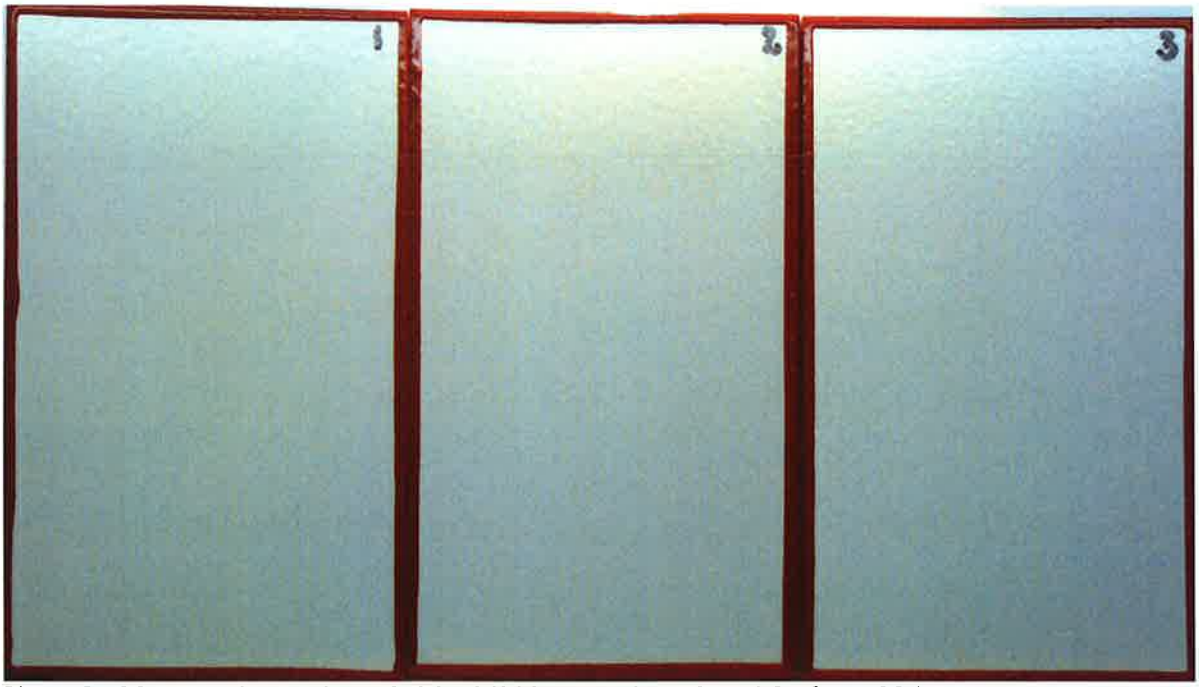

Photo 3: COT sample number 13-06-18/0387, Panels 1, 2 and 3 after 480 hours Water Condensation test.

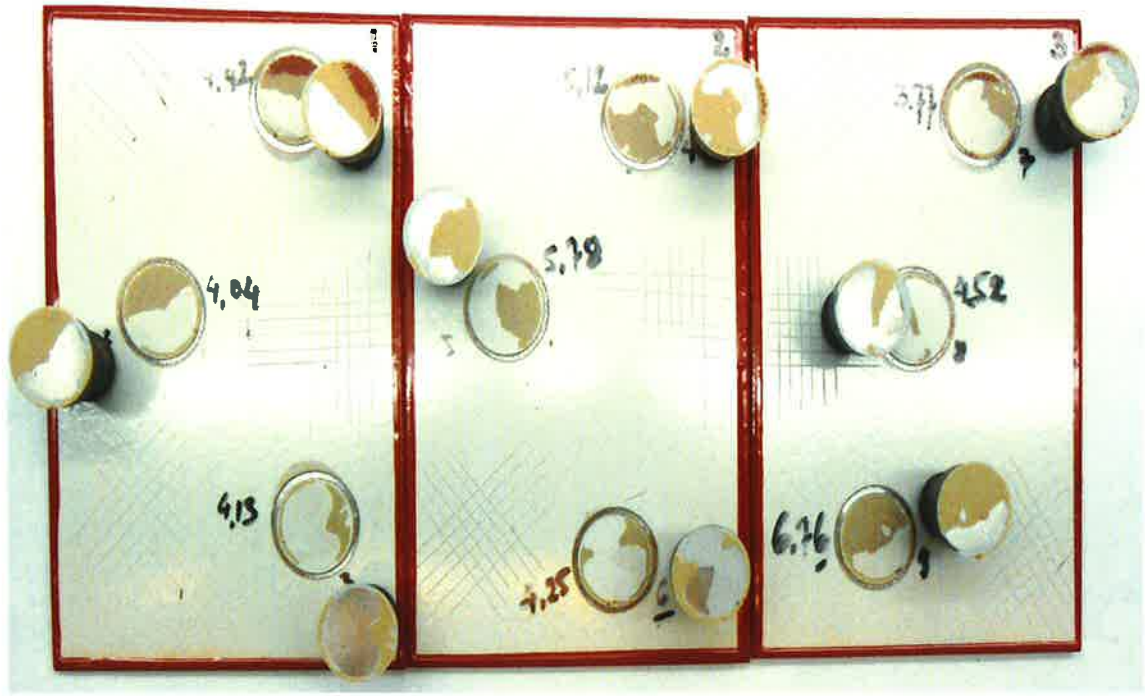

Photo 4: COT sample number 13-06-18/0387, Panels : 1, 2 and 3 after 480 hours Water Condensation test.